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Free Lighting for Franchise.

An instance of the unfair attacks to which a corporation may be subjected is brought to light in the assertion made last week by the Comptroller of New York when he said that the Brooklyn Edison Company is dodging its obligation under its franchise to give the borough a certain amount of free lighting. A large amount of space was given in the newspapers to the allegation, but we are now able to quote the interesting and effective reply of Vice-President Freeman. That efficient official, who is doing such good work in Brooklyn, shows that his company has not only given free service, but has requested the city on several occasions ever since 1898 to take some more and all that it could under the contract. Moreover, Mr. Freeman points out that the company is no gainer, as every cent paid for the franchise in this manner is deducted from its franchise assessment tax; hence the net payment would probably not be altered a cent one way or the other. Further, for seven years past, against every dollar paid to the stockholders in dividends, the sum of 60 cents has been paid to the city in taxes; so that without investing a dollar the city has virtually occupied the position of a stockholder holding 37½ per cent of the whole stock of the company. A more complete reply to an attack which even if honest in purpose, was grossly unfair in actuality, could hardly be made. Incidentally the controversy throws light on the unsatisfactory nature of this manner of "trading" free service in part payment for franchises. It rarely seems to work out well in the long run for any of the parties concerned.

The Columbus Rate Legislation Case.

A decision of importance has been rendered by Judge Thompson, of Ohio, in the case of the Columbus Railway & Light Company versus the city of Columbus, as noted already in these columns. The point at issue was whether the city of Columbus had a right to enforce an ordinance passed by its council to the effect that the rate for electricity for lighting should be 5c per kw-hour. The decision of Judge Thompson was in favor of the company. In our issue of June 16, page 1242, was given a review of the report of T. P. Linn, the special master commissioner who was appointed by the court to investigate this matter thoroughly and report to the court. The decision of the judge is in accordance with the findings of the master commissioner. The case is an important one for electric lighting companies, for the reason that it will tend to put a check on unreasonable and hasty rate regulation ordinances. While it is well established in law that a company has a right to charge a rate which will give it a fair return on its investment, and while all such cases as the one at Columbus are likely to be decided in favor of the central station company, it is nevertheless troublesome to have such ill-advised rate regulation ordinances passed, because of the necessity of contesting them in the courts. The situation of Columbus was peculiar in that by virtue of very cheap natural gas competition and the competition of two different central station companies in the down-town district, rates for store lighting have been fearfully cut and slashed so that in the down-town district rates as low as the 5c per kw-hour specified by the ordinance were common. The effect of the ordinance of course would have been to force this rate into the residence districts.

The special commissioner went into the matter of cost of production very carefully, and his report is one which might well be studied by all legislators who contemplate tinkering with electric light rates. The master's report was based upon the operating expenses and output of the company for the year 1904, and it was found that the company could not have earned a fair return on its investment had the 5c rate been in universal force. It was held that although the company was serving many customers at 5c per kw-hour it could not be forced to serve all its customers at such a rate unless it so desired. In other words, if a company wishes to make a rate too low for profit, that is the company's business, but it cannot be forced to make such a rate. The commissioner's report analyzed the cost of production with reference to the number of hours' use per day. It was found that during the year 1904 the cost (including depreciation) of furnishing 1,580 consumers using maximum current an average of one hour per day was 8.594c, while that of furnishing 803 two-hour customers during the same year, including depreciation, was 4.949c. Investigations of cost of production such as this are an excellent thing for the central station industry as a whole, as they tend to prevent unreasonable rate regulation laws and dissatisfaction with existing rates. Our own impression as to the evidence at Columbus is that the company rather understated or underestimated its actual cost. Certainly some of the items looked very small, as compared with costs elsewhere.

The Beginning of Revolt.

The current meeting of the British Association for the Advancement of Science has been marked by a protest against the hasty conclusions and enormous hypotheses of the specialists in radium. With Lord Kelvin in the lead there is open revolt against the kind of "evidence" brought forward in support of the reported transformation of elements and other semi-miraculous powers of radium. It culminated in the following stinging rebuke administered by Professor Armstrong: "Workers in the radium school appear to have cast caution to the winds and to have substituted pure imagination for it." This is severe but true, quite irrespective of the real value of the work that has been done. Whether the alleged discoveries are eventually substantiated or not; whether the marvelous conclusions are the splendid forecasts of prophetic hypotheses, or the biggest mare's nest in the history of science, the nature and amount of the positive evidence brought forward is not sufficient to warrant well-founded belief even in matters much more trivial. That helium has been obtained in spectroscopic amounts from the decomposition products of an impure haloid salt of radium has been shown some time since. Further than this, as Lord Kelvin holds, the facts do not justify hypotheses, and the fact itself is of no more significance than the finding of thiophene in benzine or of argon in nitrogen. More than this, it is well to remember that no one has as yet had enough radium to work with except by indirect methods that give very little insight into the nature of the element itself. Even its very remarkable degree of radioactivity has not yet been connected with the element itself, but only with salts of notorious chemical instability. In fact, it remains to be proved that radioactivity is a property rather than a condition.

Even the apparent liberation of energy from radium is open to an explanation entirely different from that seized and exploited by the radium school, and based on quite as sound a foundation. And it is notable that the lamented Professor Curie who discovered the phenomenon never tied himself down to the popular hypothesis advanced by others. His was the true scientific caution. He was content to lay the foundations and to wait patiently, instead of rushing into print the hastily prepared theses of admiring followers. The known phenomena of radioactivity are remarkable enough quite apart from radium. They have given a broader conception of the structure of matter. Yet no man is justified in saying in how far they are caused rather than concomitant of the phenomena observed, and to what extent they are permanent rather than casual. A stream of radioactive material uniformly coexists with a stream of radiant energy—which is cause and which effect? The whole matter needs to be overhauled conscientiously and thoroughly not with the hand that itches for the pen, but with the infinite patience of Stas, of Bunsen, of Helmholtz, of Kelvin and Rayleigh themselves. The protest is indeed well justified. No sooner did radium fall into the hands of the present school than the literature reeked with "explanations" in terms of electrons and radioactivity. Given a stuff sufficiently intangible and by hypothesis endowed with the fundamental properties of a flux and it necessarily can be made to satisfy the equations of fluents. We have had the atom of Boscovitch and the vortexation; now we have a new turn of the wheel with radium as the motive power. Right or wrong, the recent investigators have built up a tremendous structure with slender foundations and ill-braced framework. The architectural design may be excellent, but the workmanship has been hasty and careless. It is high time that the building inspectors got to work. We are glad to note that the cooler chiefs of science have called a halt, and especially that Kelvin, who as a *jeu d'esprit* could modernize the atomic theory of Aepinus, has thrown the great weight of his learning in favor of scientific caution and proper canons of scientific evidence.

Imperfections in the Realization of Resonance.

Ever since wireless telegraphy began to extend, and to render the development of selective signalling important, by the tuning of high-frequency circuits to resonance, the subject of resonance has risen to practical importance. The elementary theory of resonance is very simple. A choking coil of given resistance and reactance is connected in series with a condenser of given capacity reactance. The inductance reactance of the one is adjusted into equality with the capacity reactance of the other, and the two mutually cancel, leaving nothing but the ohmic resistance in the circuit. By keeping the resistance low enough with respect to the impressed alternating e.m.f., the strength of the current at resonance may be made as great as desired. In practice, however, there are limits which early reveal themselves when attempts are made to produce powerful resonance in the above manner. The choking coil, if it contains iron, does not possess a definite and constant value of inductance. It also possesses a relatively large apparent resistance or energy-component of impedance; owing to hysteresis. If the frequency is high, there is capacity mixed with the inductance among the layers of the winding. The condenser, again, develops an equivalent virtual shunt-path resistance, partly due to leakage and partly due to dielectric hysteresis. Consequently, even if there be no iron core in the choking-coil, the resonant circuit virtually consists of an inductance with a spuriously increased resistance, shunted by a certain capacity, and connected in series with a condenser which is also shunted by a certain resistance. Under these conditions the tuning, or mutual counteraction of the two reactances, is

necessarily rendered imperfect for all adjustments and the resonance ratio; i.e., the ratio of the current through the circuit at resonance to the current through the choking coil only, instead of being an ideally possible very large number, seldom exceeds the value 100.

A recent number of the *Elecktrotechnische Zeitschrift* contains an article by Dr. Benischke upon the imperfections of dielectrics from the standpoint of resonance requirements. The various losses of energy occurring in condensers connected in resonant circuits are analyzed and discussed. Although the resonant circuits of today are relatively very imperfect, for the reasons above stated, yet there is a good prospect of their improvement in the future, by increased knowledge, selection of materials and careful design. It should certainly be possible to reduce the virtual capacity mingled with the windings of an induction coil, even if this necessitates a reduction in the effective inductance of the coil. Again, it should be possible to find dielectrics of minimum hysteresis coefficient. This alone would be a distinct boon to the art of tuning high-frequency oscillators. There is a wide field of useful research open to investigators in this direction. Up to the present time, compressed air seems to be the best dielectric for storing large energy with minimum hysteretic waste. Air at ordinary pressure has inappreciable hysteresis; but it will not store much energy, or resist much voltage.

THE METER READING RUSH.

In some central station organizations there is a grand rush about the first of each month to get the meters read and bills sent out in time. The reading of meters is all confined to a few days about the first of the month. In some companies this plan seems to work well, but where it does not work well and where the confinement of this work to a few days results in overworking everyone connected with the operation to the point where other important current work is neglected and mistakes are invited by the hurry, there is little excuse for continuing the practice. There is no reason why meter reading cannot be spread out over the month like other work, and a number of companies have broken away from the old practice of first of the month reading. The practice at Dallas, Texas, described elsewhere in this issue, is to read a few meters nearly every working day of the month, thus keeping both readers and billing clerks steadily busy. By reading meters always in the same rotation the readings of any given meter are made a month apart. The practice at Hartford described some months ago (March 3, 1906) also spreads the work of meter reading and billing over the month, in a similar manner. The plan saves delay in getting out bills and on the whole is much to be preferred to bunching this work unless the organization is such that this is done without undue pressure.

ERRORS IN PHOTOMETRY DUE TO ANGULARITY.

We are accustomed to regard photometry of light sources differing in color, *i. e.* of heterochrome lights, as a field for the display of technical imagination, or scientific guesswork, as distinguished from exact measurement. It is quite interesting to find how varying may be the estimates of different earnest and truthfully inclined persons in their attempts to measure the horizontal candle-power of an enclosed arc-lamp by comparison with a Hefner standard lamp. Of course, this does not apply to monochrome photometry, and 3¼-watts-per-candle lamps may be photometrically compared with a very satisfactory degree of precision. An article has recently appeared, however, by Mr. L. W. Wild in "The Electrician" (London), calling attention to errors of five per cent or so, which lie latent in monochrome photometry, as practiced with certain types of photometer used industrially. If this is the case with lights of the same color, we dare not contemplate what the errors might be in such cases with lights of different colors.

The photometers impugned are wedge photometers. That is, beams of light from the sources under comparison do not normally fall upon a perpendicular screen; but falls upon a screen or screens at an incident angle of some 60°. A wedge is presented to the observer, so that the photometer setting is made to secure equality in his estimation of the illumination on the two faces of the wedge. The article points out that if the wedge is not pointed accurately towards the observer, the difference between the incident angles of light on the two faces will appreciably influence their illumination. A displacement of the wedge by a single degree of arc is capable of altering the ratio of the two face illuminations by six per cent. Such small displacements are readily possible in the side play of the photometer carriage on its track. Mr. Wild goes on to describe an improved form of flicker-photometer in which this angularity error cannot occur. One face only of a rotating disk is viewed through a telescope.

There can be no doubt that flicker photometers give the most definite results with herterochrome lights, and results that check best when repeated by different observers. As pointed out by the article, angularity error is ruled out of those photometers in which the light falls perpendicularly on the screen, as in the Lummer-Brodhun screen which is the most generally used in this country. For monochrome photometry, a modification of the Lummer-Brodhun screen has recently been introduced abroad which possess distinct advantages in precision of setting and in estimation of illumination equality. The ordinary Lummer-Brodhun screen provides a slab of gypsum perpendicular to the two beams of light compared, and the observer, looking through a short telescope, views one face directly, and surrounding it an annular image of the other face. The photometer setting is adjusted until the annulus appear of equal brightness with the central patch within. At equal illuminations, the two fade into a single disk of uniform tint.

The modified type of screen presents a view of two half faces of the slab side by side, but in each half face there is a darker portion where the illumination comes from the opposite face, but with a definite amount of absorption. The observer first sets the photometer until the two half disks appear in the telescope side by side and equally bright. This is practically equivalent to the setting obtained with an ordinary wedge photometer viewed through a telescope. Then he makes a final adjustment of the setting until the contrast of the shaded areas on each half-disk have equal intensities with respect to their brighter backgrounds. This gives the final setting with increased precision, because two contrasts of light and shadow can be adjusted into equality with greater precision than two like illuminations can be brought into agreement. In other words, the eye can estimate equality of contrasts more precisely than uniformity of tint.

Lighting Service in Exchange for Franchise.

A very interesting and important point in public lighting franchises was touched upon last week, when Comptroller Metz, of New York City, alleged that the Edison Electric Illuminating Company of Brooklyn has collected payment from the city for lights which, by the terms of its franchise, should have been furnished free. Mr. W. W. Freeman, vice-president of the company, has made the following statement in reply: "The impression one would obtain from a casual reading of the statements referring to the matter of free lighting provided for in the franchise of the Edison Company, is very erroneous and unfair to the company. Although the comptroller distinctly states in quoting the corporation counsel, 'that such lighting was not furnished was the fault of the city and not the company;' the article states that the Edison Company has neglected to allow for free lighting which it was obligated in its franchise to furnish. This is not the case. The Edison Company does not owe the city a dollar on any account, but has paid all taxes and obligations of every character whatsoever up to date. On the contrary, the city owes the Edison Company upwards of two millions of dollars, having paid nothing whatever for lighting furnished in streets and public buildings since December 31, 1902.

"The franchise of the Edison Company granted in 1888 gives the city the privilege of designating locations at which it can require the company to furnish a number of free lights proportionate to the lights furnished to its commercial customers. The initiative in the matter must be taken by the city, and is in effect an option without obligation on the part of the Edison Company to act other than in conformity with the city's instructions.

"It is not true that this franchise provision has been ignored for sixteen years, as stated. Up to and including the year 1897 the Commissioner of City Works of the city of Brooklyn regularly designated the city's quota of free lights and the same were furnished. The failure to designate the full quota of free lights which the city could have obtained has been confined to the period since 1898, during all of which time, however, all of the lights previously designated have been continued in service as free lights, such lights constituting a very large proportion of the entire service which the city could probably have claimed.

"During this period the Edison Company has not only been willing to meet its full obligations, but has repeatedly called the attention of the city authorities to this provision in its franchise and has, at different times by official communications, requested the city to designate additional lights to make up the full quota of lighting service. (Mr. Freeman cites several specific instances.) In all of these letters the Edison Company urged upon the city its willingness and desire to meet every reasonable franchise obligation and the company has done everything that it could properly do, and much more than it was required to do in this entire matter.

"It is true that there is a difference of opinion as to the reasonable interpretation of the franchise provisions as they apply to new lighting developments not contemplated or even imagined at the time the franchise was granted. The maximum amount of such free lighting under the most extreme interpretation favorable to the city would amount, at the present time, to approximately $12,000 annually. Whereas, under the interpretation which the Edison Company believes to be reasonable, and which it believes the courts will sustain the amount would not exceed $3,600, at present and would be less for each previous year. The amount of free lighting that has been furnished to date under previous designations approximates $2,000 annually. It is not strange therefore that the Comptroller says in his statement 'the amount involved in this case may eventually be determined to be relatively small.'

"It is doubtful, furthermore, whether the failure of the city to designate additional free lights has involved any actual loss to the city, inasmuch as it is claimed that all amounts paid as franchise taxes or assessments are proper deductions from the amount of tax paid under the assessments of the company's franchise by the State Board of Tax Assessors, which for the year 1906 exceeds $7,000,000. If this view is sustained, as the company believes it will be, the net payment to the city would not be altered by the amount of free lighting, as the value of whatever the company supplies in free lighting would be deducted from what it would otherwise pay in the form of its franchise tax.

"While on the subject of taxation, it may not be amiss to remark that for every dollar paid by the company in dividends to its stockholders during the past seven years, the sum of 60 cents has been paid by the company to the city in taxes, which means that without investing a dollar the city has stood in the relation of a stockholder owning 37½ per cent of the stock of the company and receiving dividends thereon. The appreciation of this is all that is necessary to acquit the Edison Company of any possible charge of failure to pay its full burden of taxation or a fair and full return for its franchise rights.

"The Edison Company always has been, and is to-day, willing to meet fully every obligation to the city or anyone else, that it has ever assumed. It has not failed to do this in any matter, and its record is clear in all its relations with the city as the above facts will show."

Jews Barred from Vienna Municipal Plants.

An interesting article appears in the New York *Evening Post* of August 11 on the expansion of municipal ownership brought about in Vienna by the Christian Socialists, whose programme involves entry into every field of human activity. The rule of permanence in the municipal service has been too firmly established in Vienna, as in other German cities, to permit of anything like a wholesale removal of officials and employees for racial or other political reasons. But it seems clear that no Jew can hope for any appointment in the municipal service under the Lueger rule. And it is openly asserted that, in the exercise of their discretionary powers, the officials do not hesitate to refuse privileges to the members of the hated race which are readily granted to others. As to the electric lighting and street railway plants it is said: "Construction of the municipal electric plant dates from 1900; and the works began operation in 1902. The plant consists of two separate works on the same tract of land, near the gas works. One building contains the power plant for the street railway; the other is for lighting and for power to private consumers. But current may be transferred from one to the other if needed. For the construction works a loan of $6,000,000 was made by the city. There are also three private electric companies in Vienna. And while the municipal plant has rapidly extended its service, in 1905 it furnished only about one-third of the electric current sold to private consumers. Including the street railway service, the municipal plant furnishes about two-thirds of the electric energy in Vienna. As in the case of the gas works, the municipal electric plant is operated for financial profit rather than to extend the use of electricity by low rates. On the face of the reports a large profit is shown. In 1905, after deducting operating expenses, interest, and depreciation charges, the net surplus was $500,000—more than 8 per cent of the capital investment, and 30 per cent of the gross income. But the income is in large part an estimated revenue from the current used for public purposes. Nearly half of the total income is for power furnished to the street railway service. This is charged at the rate of three cents a kilowatt hour, compared to seven cents as the average rate received from private consumers. This seems to be about cost; and on the surface does not seem to be too high a charge for the street railway current, which is two-thirds of the output of the whole plant. But a small change in the rate charged against the street railway service would modify so much the financial results of the electric plant, that safe conclusions can hardly be drawn from the published reports.

"Of more importance than either the gas or electric plants has been the municipalization of the street railways in Vienna. It is the largest municipal street railway system in the world; and one of the most recent. Before the city government took up this work, there were two street railway companies, operating in 1899 seventy miles of line and carrying 85,000,000 passengers. Only a few lines had been electrified. In that year the city received the necessary authority from the Imperial Railroad Department to construct a new electrical system, including the rebuilding of

the lines of the larger of the two companies and a large number of new lines. The company went into liquidation, and disposed of its lines and rights to the city.

"A contract for the new construction work and temporary operation of the lines was made with the Siemens & Halske Co. In 1902 the lines of the smaller company were also transferred to the city. And on July 1, 1903, the municipal government took over from the contractor the operation of the whole system. For the purchase of the old lines and new construction and equipment, the city issued a loan of $25,000,000. The mileage is already double that in 1899, and new lines are being steadily constructed. No cars run through the old inner city, where the streets are still too narrow for car tracks. But most of the lines run at least to the Ring Strasse, and many of them run for some distance on the Ring. This facilitates transfers from one line to another; so that one may go from one part of the city to another in most cases with one change of cars. The equipment is entirely new, and the cars are larger than in other European cities."

Electric Steel Cars for Pennsylvania Tunnel.

For the Pennsylvania Railroad in its new electrical regime, all its passenger car equipment is to be of steel throughout. One thousand of the new cars will be ready when the New York tunnel is completed. There will also be some five hundred Pullman cars which will also be of completely non-comubustible construction. At the request of the Pennsylvania Railroad, the Pullman Company is now building the first all-steel sleeper ever constructed.

The standard Pennsylvania new car weighs 103,550 pounds, against 84,900 for the standard wooden coach, but it is found that the added weight greatly reduces the vibration and adds to the comfort of the passengers. No inconsiderable part of the additional weight is due to the burden involved in carrying storage batteries and battery boxes. All the new cars are to be lighted by electricity, and the Pennsylvania will carry no gas illuminated cars of any kind into the New York tunnel. The electric wires in the new cars are insulated in heavy metal conduits, thus adding to the safety.

The new car is non-collapsible. Its hidden frame is like a cantilever bridge, suspended on the trucks as piers. This safety against telescoping is secured by the use of enormous steel girders, the principal feature in the body of the car being a central box girder 24 inches wide by 19 inches deep, extending throughout the length of the coach.

The flooring throughout the car and platform consists of an imitation of stone spread while in a plastic state over the steel plates of the car. The framing above the windows is composed of steel plates. The doors are composed of steel plates pressed into a shape imitating the wooden doors used in other cars, and filled with cork to deaden the sound. The roof is constructed of composite boards covered with copper sheathing. The inside lining consists of composite boards covered with fireproof paint.

Profit on Municipal Plant Investment.

Attention was recently called in these pages to the special statistics of the U. S. Bureau of the Census dealing with the taxes, expenditures, investments and plants of 151 cities in this country. Further comment on these data is made by the New York *Times* as follows: "These 151 cities have a budget rivaling the United States Treasury's, and showing signs of unmanageability. Taxes supply only two-thirds of the revenue, leaving too large a balance to be raised from casual sources or by borrowing, which is constantly increasing. Not long ago former Controller Coler indignantly denied that expenses were outrunning population under his administration. It is now disclosed that expenses increased five times as fast as population between 1902 and 1904. The 151 cities increased their expenditures 18 per cent, but New York increased 29 per cent. Speaking roughly and for all cities, taxes and salaries about balance, leaving special revenues and borrowing to maintain municipal industries, water works, docks, and so on. The aggregate value of municipal plants of this sort is $790,570,726, and they are about half paid for. On the one hand this is prudent finance, compared with British practice, which allocates scarcely any tax money to reduction of capital account. On the other hand it reveals the wastefulness of municipal ownership.

"Cities show that $6 of investments by them are necessary to earn a dollar of gross income, while private investments in many States show dollar for dollar—indicating how much more cheaply cities can get things done for them than they can do them for themselves. Such is the wastefulness of public administration as here disclosed. The aggregate debt of the 151 cities is about double the National debt, or, deducting sinking funds, the net municipal debt is one-fourth larger than the National. The per capita city debt is $56.97, against $11.91 for the United States. But while the National debt is decreasing, the city debt is increasing at an ominous rate, and increasing on the worst side—that of municipal trading. For example, municipal electric plants have increased from 1 to 1,050 in twenty-five years. The plain dilemma disclosed by this tendency is either that credit must be strained or industries starved for lack of capital. The increase of indebtedness is bad enough, but the waste is worse. There is perhaps no case upon record where a city has made a profit in a competitive trade, which is only another way of saying that whatever the city supplies costs taxpayers dear. It is because New York supplies so much that it is so much ahead of all other cities in extravagance."

Earning Power of Telegraphy and Telephony.

Some interesting figures have been compiled recently in Boston, as to the relative earning powers of telegraphy and telephony. In the ten years ended December 31 last the toll and long-distance service of the American Telephone Co. and its subcompanies increased from $4,000,000 gross to $30,000,000, a gain of $26,000,000, or 650%. In the same period the gross business of the Western Union increased only $6,815,626, or 30.6%. During these ten years, however, the Western Union has had to meet the sharp rivalry of the Postal Telegraph Co., practically all of the growth of which has been crowded into the past five or six years and the bulk of which has been at the expense of the Western Union. The following table shows the rapid growth in the toll-line telephone business:

Gross.	Toll and Long Distance.	Western Union.
1905	$30,000,000	$29,033,635
1895	4,000,000	22,218,019
Increase	26,000,000	6,815,626
Per cent increase	650	30.6

In 1895 the number of telephone toll and long-distance calls per annum was only about thirty per cent of the total number of messages handled annually by the Western Union. To-day the tables have been reversed and during 1905 the number of toll calls was nearly double the messages handled by the Western Union. The subjoined table outlines this growth:

No. calls.	Toll and Long Distance.	Western Union.
1905	118,522,000	67,477,320
1895	16,400,000	58,307,315
Increase	102,122,000	9,170,005
Per cent increase	622.5	15.7

Further evidence of the growth in the capacity of the telephone toll business to compete with the telegraph is found in the rapid increase in toll wire mileage. In 1905 for the first time in the history of the telephone industry, the number of miles of toll wire passed the wire mileage of the Western Union. The expansion of the past ten years is shown as follows:

Miles wire.	Distance. Toll and Long	Union. Western
1905	1,265,236	1,184,557
1895	305,938	802,651
Increase	959,298	381,906
Per cent increase	313	47

The gross reecipts per message have shown little fluctuation in the case of either the telephone or telegraph services. The gross per toll call for 1905 was 25.3 cents and per telegraph message, eliminating "dead-heads," was 31.6 cents, an increase of about 1 cent per message in ten years for each service.

A Hydro-Electric Plant for the Farm.

In contrast to the gigantic power developments of to-day, it is interesting to call attention to the electric power and lighting plant on the farm of E. B. Miner, at Oriskany Falls, Oneida Co., N. Y. This plant is distinctive as being probably the only one of the kind in this country. Certainly there can be very few like it, if any. It was planned and built under the supervision of Mr. Miner's son, Ralph K., a young electrical engineer of ability. Through Mr. Miner's farm flows the Oriskany Creek, a stream of normally about 4,000 cu. ft. per minute. On October 16, 1905, was begun the construction of a power plant on the bank of this stream; a small dam of the "flow" type, 36 ft. wide with concrete walls and mud sills, and planked with 4-in. hemlock on a heavy timber frame, the latter being imbedded in and bolted to the walls and sills. A double planked apron receives the fall of water that flows over the dam, and prevents the undermining of the walls. The extremely low head of 4½ ft. necesitated installing a comparatively large wheel. A 30-in. vertical improved "Samson" built by the Jas. Leffel & Company was decided upon. This wheel is rated at 17½ hp at 113 r.p.m. under a working head of 4½ ft. The power is transmitted through a pair of bevel mortise gears, and belted to a "Type S" Westinghouse generator of 12½-kw capacity at 250 volts and 1,100 r.p.m. The generator is connected with the farm buildings 1,500 ft. distant, by a line consisting of bare aluminum cable—equivalent in conductivity to No. 2 B. & S. copper—strung on cross arms mounted on cedar poles, set about 100 ft. apart, the insulator pins in the cross arms being 24 inches apart. The wheel pit walls, which also support the flume and that in turn the power house, are of concrete, built on a good gravel foundation, the bottom of the pit being planked to prevent washing.

As soon as the weather permits, it is proposed to raise the head to 6 ft., increasing the power to about 27 hp. The plant was started up December 27, 1905, and has been in constant operation night and day, without any attention oftener than two or three times a week, and without a governor of any description to regulate it. An increase of water in the stream to about ten times the normal quality made no apparent change in voltage. However, a governor, designed by Mr. Miner, will be attached to the wheel gate in the near future, and may be on by this time.

At first only part of the available power was used, as 25-16 cp, 220-volt lamps in the house and 8 in the barn, give very good illumination, while a 4,000-watt heater has replaced the customary coal stove and keeps the temperature of two rooms—16x13x7½

FIG. 1.—POWER HOUSE AND DAM.

FIG. 2.—PARTIAL VIEW OF INTERIOR OF POWER HOUSE.

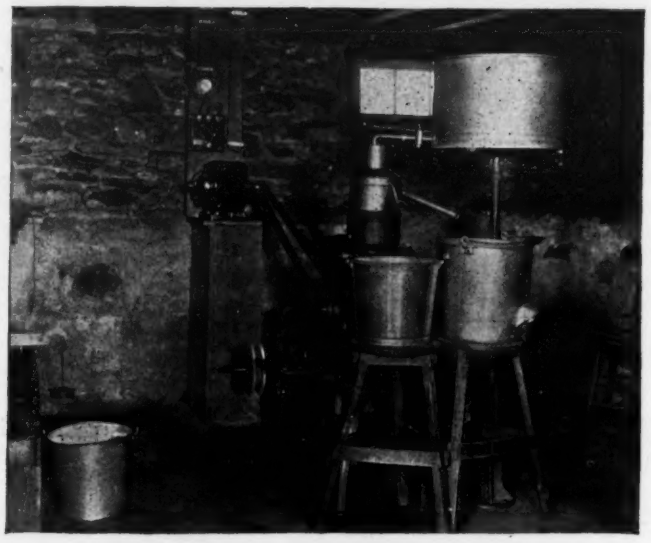


FIG. 3.—CREAM SEPARATOR OPERATED BY MOTOR.

FIG. 4.—ELECTRIC HEATER AND COAL STOVE DISPLACED BY SAME.

ft. and 12x13x7½ ft—at about 75°, when the outside temperature is 0° F. and above. Each room has two windows. A ½-hp motor runs the cream separator, churn and grindstone. A smaller motor would do the work were it not for bringing the heavy separator bowl up to its speed of about 7,400 r.p.m.

It is proposed to do the cooking as well as furnishing power for all the farm machinery to which it can be applied as soon as it is possible to make the changes to electrical power. This plant has been the cause of numerous inquiries from different people, asking if it were not possible to duplicate this plant on their property. There are many places throughout the country where small water power of from 10 to 50 hp could be utilized and plants similar to the above could be installed, and very likely will be now that Mr. Miner's installation has proved such a success. It is interesting to note that quite recently a small manufacturing industry has been established nearby, invited by the available power and other conditions, so that we have here a novel illustration of the "return to the soil" idea, offsetting the drift to the cities. There is no reason why electrified farms like this should not again become industrial as well as agricultural centres, even if on a small and modest scale.

Tungsten Incandescent Lamp.

The General Electric Company has for many years been engaged in the development and perfection of a pure tungsten filament for the manufacture of high candle-power incandescent lamps. Tungsten possesses the property of withstanding very high temperature, and when used as a filament for an incandescent lamp shows a consumption of between 1 and 1¼ watts per candle. The life of the tungsten lamp is at least equal to that of the ordinary incandescent lamp. The recent results attained by the General Electric Company in the production of tungsten filaments, place it in the front ranks of those who have been engaged here and in Europe in working upon this difficult problem. The important announcement reaches us as we go to press that preparations are being made by the General Electric Company for the manufacture of these lamps of high candle power upon an extensive scale and that these lamps will now be available.

CURRENT NEWS AND NOTES.

MUNICIPAL ELECTRICIANS.—The International Association of Municipal Electricians has met in annual convention at New Haven, Conn., where a good programme has been provided and where a programme of lavish entertainment will be carried out.

ILLINOIS STATE ELECTRIC ASSOCIATION.—The Illinois State Electric Association will hold its convention this year at Springfield, September 19 and 20. The headquarters will be at the Leland Hotel. Exhibits by manufacturers and supply houses are invited. Mr. H. E. Chubbuck, La Salle, Ill., is secretary.

MILAN RAILWAY CONGRESS.—An international electric and street railway congress is to be held at Milan, Italy, September 17-21, in connection with the Exposition. It will be opened by the minister of public works. One of the features will be a reception by the Italian Edison Company of Milan and a visit to its fine power house. Another visit includes the single-phase road in the Val Brembana, and the Valtelina three-phase road. Mr. G. Semenza is to present a report on the application of steam turbines to electric railway work.

CHEAP TELEGRAPHY.—Mr. Henniker Heaton, a member of the British Parliament, who is advocating reducing the cost of telegrams from England to India from 50 cents to 12 cents per word, states that the transit charge for a telegram to Australia, via India is 9 cents from the United Kingdom as far as India and that the Russians pay only 9 cents a word from St. Petersburg to Vladivostok, 1,500 miles farther than from England to India. Mr. Marconi has offered, in event of war, to construct a wireless telegraph station at Cyprus for repeating wireless messages from and to India and the United Kingdom. The high charge to India, Mr. Heaton asserts, is due to a trust or monopoly agreement.

NEW YORK-CHICAGO TROLLEY.—It is stated that the articles of consolidation of three railroads in different part of Pennsylvania will be filed at Harrisburg this week, which will constitute the formal announcement of a project of prominent foreign bankers, associated with Joseph Ramsey, Jr., former president of the Wabash Railroad, to build a low-grade double-track electric railroad from New York to Chicago by way of Pittsburg, which will cost about $150,000,000. Complete surveys have already been made, and it is expected that work preliminary to actual grading and construction next spring will begin this fall. It is expected that the road will require three years to construct. It is proposed to operate it with electric locomotives from the beginning. It will be known as the New York, Pittsburg & Chicago Air Line, and will be sixty-five miles shorter to New York than the Pennsylvania, and 108 miles shorter than any other line between New York and Chicago. The new Keystone Air Line will traverse the important bituminous coal fields of Central Pennsylvania, now controlled by the Pennsylvania Railroad, and will also pierce the anthracite region throughout its length. It will not only be the shortest line through Pennsylvania, but it will cross the summit of the Allegheny Mountains 400 feet lower than the Pennsylvania, and will have very easy curves and remarkably low grades for a mountain line. The cost of the line between Pittsburg and New York, Mr. Ramsey says, is estimated to be between $75,000,000 and $100,000,000, all of which has been pledged, the bulk of it by foreign capitalists. The merger papers to be filed this week will provide for the consolidation of the Indiana, Clearfield & Eastern, the Allentown, Tamaqua & Ashland, and the Brush Creek and Crow's Run railroads.

INTERCOURSE FOR COMPANY EMPLOYEES.—In a paper read before the Western Gas Association on the relations with employees Mr. J. M. Berkley, of Los Angeles, Cal., says: "There are various ways of introducing social features entirely along educational lines that are very effective. We can refer with great satisfaction to a new and effective organization in the company with which I am at present connected. Eight years ago they had but few employees, numbering less than fifty; now they number up into the hundreds, and over these hundreds are placed foremen whose business is that of the usual foreman, but each foreman is given to understand that fair dealing must be and is the rule. At an interval of about every three months the foremen of the gas and electric departments, numbering about 60 men, are brought into the general office, where a meeting is held along the same lines as are the meeting of our organization, the company bearing all the expenses incident thereto. At the same time there is interwoven into the fabric a distinct and discernible feeling that our company is not spending its money without a definite expectancy of returns. These men are better fitted for their duties by these meetings as a result of the educational features. They are socially made acquainted through the little banquet furnished by the company. The result of all this is, as it must be wherever practiced, that these men go away swearing allegiance to the interest of the company, defending its rights, working out its principles, and consequently adding to its ultimate financial success. The general superintendent of our company, being a man of very high principles and integrity, accords to every man employed by the company a hearing, to which I believe all men are entitled, as the little personalities which are apt to creep into the direction of affairs through the foremen and assistant superintendents, makes this course necessary. We can truly say, without question, that the company owns the hearts of the men it employs, as well as their time; therefore labor troubles are unknown. What I have stated of this company is just as true of the small company employing but a few men, as it is of this."

ADJUSTING POLE RIGHTS.—In a town in New England in the vicinity of Boston, the pole line rights of a public service corporation were held up for a year and a half, and were not settled until recently, when one of the selectmen got a refund of an alleged overcharge of $5. As a matter of fact, the company says, there was absolutely no overcharge at all; "he merely thought there was one"—which is a charitable way of putting it.

STORY OF THE TELEPHONE.—An article in the September *Scribner* will celebrate the thirtieth anniversary of the invention of the Bell telephone. It is a popular account, scientifically accurate, of the development of the crude speaking toy of 1876 into the indispensable adjunct of commercial and social life employed to-day. The author, John Vaughan, will make clear to the layman the essential features of this invention which now enjoys such an extraordinary extension of its public utility and service in the telharmonium.

SUBMARINE TELEPHONY.—A cable dispatch from Berlin, of August 9, says: "Experiments began to-day at Lake Constance with a submarine telephone constructed under Professor Pupin's system. The cable connects Friedrichshafen, on the northern shore of the lake, in Wurtemburg, and Romanshore, on the opposite, southern shore, in Switzerland (a distance of about seven miles), and reaches a maximum depth of 820 feet. It was laid by the Siemens-Halske Company for the Bavarian, Wurtembergian, and Swiss telegraph departments. No information regarding the results has yet been made public."

THE A. I. E. E. MEMBERSHIP.—The list of members in the American Institute of Electrical Engineers, July 1, has just been issued. It gives the surprising total of 3,982, not including the enrolled students, of whom there are 647. The grand total of 3,982 members is constituted by 2 honorary, 509 active and 3,471 associates. Of these 3,428 are American, 553 are in foreign countries, and there is only one whose address is unknown. Among the States, New York leads with 1,219 members, followed by Pennsylvania with 381; Massachusetts, 278; Illinois, 241; Ohio, 201; California, 134; New Jersey, 128. No other State yet reaches 100, but Missouri has 91 and Wisconsin 61. The foreign countries are headed by England with 138; Canada comes next with 124. Mexico has 45 and Japan 30. Nearly forty countries and colonies are listed.

ELECTRICAL ACCIDENTS.—Data as to electrical accidents in England are contained in the electrical section of the annual report of the Chief Inspector of Factories and Workshops for 1905, prepared by the electrical inspector to the Board of Trade. It shows that, apart from the accidents of a non-electrical character at electric supply stations, the electrical accidents were thirty-five in number, and three of these were fatal. In the first case the victim was aware of the risk of the operation which he intended to perform, as he provided a rubber mat to stand on; but he neglected the additional precaution of putting on the rubber gloves which were supplied. The apparatus proved to be defective, and the man inadvertently stepped over the edge of the mat on to the iron floor plating, and paid the penalty with his life. The remarkable fact in this connection was that india-rubber gloves, could have been used without inconvenience for the work to be done.

WISCONSIN WATER POWER.—"Much interest is shown at the present time in water power development in the State of Wisconsin," says a bulletin issued this month by Chief Hydrographer Leighton, of the U. S. geological survey. "A single firm of engineers has received during the past year over thirty applications from clients for preliminary plans for water power plants. Many of these projects contemplated the transmission of power a considerable distance by electricity. The United States geological survey which is measuring the flow of streams in all parts of the country, is carrying on in Wisconsin as much work as the available funds will permit. Surveys of streams are being made in co-operation with the State and river gaging stations are being maintained at the following points: Black River, at Neillsville; Chippewa River, at Chippewa Falls and Eau Claire; Flambeau River, at Ladysmith; Oconto River, at Gillett; Peshtigo River, at Crivitz; Wisconsin River, at Merrill; Necedah and Rhinelander and Wolf River, at Shawano."

TELEPHONY IN HARVEST TIME.—It is reported by one of the Kansas City newspapers that Mr. J. A. Frambers, of Oxford, has put the telephone to a new and novel use. Sumner County is covered with a network of rural telephones; all told, there are more than 3,000 telephones in the county. Mr. Frambers kept his threshing outfit in constant communication with these telephones. He is a member of the Oxford Mutual Company, and has had a telephone installed in his cook shack. Whenever Mr. Frambers moves his threshing outfit to a farmer's premises his cook shack telephone is immediately connected with the telephone wire running along the highway, and no matter how far out in the country he may be Mr. Frambers and his cook are in constant communication with the grocers, butchers and other supply houses. Mr. Frambers can also call up almost any farmer in the county to talk threshing to him, and the "next" man on Mr. Frambers' list can, simply by using the telephone in his home, learn just when the threshermen will arrive at his place.

OHIO ELECTRIC LIGHT ASSOCIATION.—The twelfth annual convention of the Ohio Electric Light Association is to be held at Hotel Victory, Put-In-Bay, on Tuesday, Wednesday and Thursday, August 21, 22 and 23. The following are some of the topics upon which papers will be presented: Natural gas engines in competition with electric motors. What inducements should be given to increase business in villages or small cities in which the population is not increasing? Description of wiring of a moderate-priced residence scientifically lighted. Progress of high efficiency lighting unit in Ohio by central station men. New business, how to get it and how to keep it. One successful way to get business. Legislation, its uses and abuses. Report of committee on cost determination. Report of committee on publicity. Luminous arc lamps with mercury arc rectifiers. Electric heating and cooking devices (illustrated lecture). Notes on high efficiency lighting units by the manufacturers and wiring for electrical appliances, other than lamps. On some of these subjects as many as four papers will be presented. An urgent invitation is extended to the ladies to attend this convention, particular attention having been given to their entertainment. A large number of prizes have been donated for distribution among the ladies attending, and there will be the usual amount of entertainment.

BRYAN ON OWNERSHIP.—It is stated that Mr. W. J. Bryan, former Democratic candidate for the Presidency on a silver platform, will on his return advocate a modified scheme of State ownership of utilities. One of the many striking impressions, it is said, that have come to Mr. Bryan on this tour has to do with the ownership of the great public utilities by the State, with especial reference to the railroads. Mr. Bryan has been in Europe on other occasions and examined the conditions surrounding the Government management of the larger arteries of travel. In one very important particular he would apply the theory differently to the United States. His plan would admit of the ownership of certain trunk lines by the general government, in order that the efficient through services should not in any way suffer impairment, but he would insist that the local lines in every State be owned by the separate States, thus preserving more effectually the idea of State individuality, which, in Mr. Bryan's opinion, would in time be wiped out if all lines passed into Federal control. The enormous patronage that would be the result of such a railroad management in America would, of course, tend to intrench the party in power and would in time accomplish what Mr. Bryan fears and would contend against—the abolition of State boundaries. It is no part of Mr. Bryan's intention at this time to take up the trivialities of public ownership. He is said to be considering the subject in its broadest aspect, developing at the same time an entirely new feature—that of individual State ownership. This feature is, however, by no means new, and every State that has owned railroads has either sold them or is wishful of doing so.

THE TROLLEY IN INDIANA.—Advices from Indianapolis state that competition on the part of the electric railways is causing considerable uneasiness among railroad officials, and that they are agitating the calling of a meeting of passenger and freight officials to consider the question.

TELEGRAPHY IN MONTANA.—The Great Northern Railway has made over to the Western Union Telegraph Co. for commercial purposes the use of the wires along its lines from Great Falls to Butte, Mont., thus giving the Western Union the exclusive use of all the wires on the Great Northern system.

TESTS OF STEAM PIPE COVERING.—The April bulletin of the engineering experiment station of the Iowa State College, Ames, Iowa, contains the reports of tests carried on by Messrs. A. Cammack and T. E. Woodman on the effectiveness of steam pipe coverings on pipes of from one inch to seven inches diameter. The covering tested was 85 per cent magnesia. The conclusions drawn were that under fairly average conditions for every size of pipe tested the single covering is more economical than the double, including interest and depreciation on the extra cost of the double covering at 15 per cent per annum.

A GOOD LIGHTNING STORY.—The following story from Derby, Conn., of August 8, might well be termed a "corker" by the incredulous: A dozen uncorked bottles containing ink and other fluids were thrown down a stairway by lightning without spilling any of their contents at the home of William M. Davis last night. The bolt entered a window, circled a brass bedstead in which Mr. and Mrs. Elsworth E. Straun were sleeping, then leaped to a shelf on which were the bottles and a lamp. The bottles were swept out of the room a distance of twenty feet to the hall on the floor below. The lightning left the house by the wire of the electric doorbell, ringing the bell as it did so and burning the hair of Mr. Straun's dog, which was on the veranda.

PREVENTING SEA COLLISIONS.—U. S. Consul J. I. Brittain, of Kehl, reports that a Berlin engineer has applied for a patent for an invention to avoid collisions between vessels at sea. By the system vessels are supplied with special wireless telegraphic apparatus which acts over a short circuit, even as short a distance as half a mile. As soon as a vessel enters within a certain distance of another vessel, this telegraphic apparatus acts automatically in such a manner as to close the steam tube to the screw on each vessel. The machinery is thus instantly checked, and the steamers have time to reverse the engines or reduce speed. In this manner accidents can be prevented. The apparatus is for use in fogs and other heavy weather. The wireless control of distant apparatus is by no means a new idea.

WATER IN THE NEW YORK SUBWAY has proved to be about the worst difficulty yet encountered. On August 7 the underground trains were again stopped for hours, in the evening, by water which flooded the tracks between Worth and Canal Streets, where an opening in the side of the subway had been made to put in a ventilating plant. Added to the rush of surface water from the rainstorm were the contents of a large sewer main close at hand, which burst from the unusual pressure. Passengers in some of the trains were imprisoned an hour before the cars could be brought near enough to a station to unload. Traffic was restored towards morning. Manager Hedley made free use of motor pumps to get the water out. An extensive pumping equipment seems to be in order as a defence against the breaks in the city water mains.

"MAKE AND BREAK."—For some time past considerable trouble has been experienced on the long distance telephone line between New Albany, Ind., and Indianapolis, with frequent stoppage of communication. The trouble has at last been discovered. At one point the wire passed through the forks of two small limbs of a tree, and as they grew, they inclosed the wire and embedded it in the wood. Whenever rain fell the twig swelled tight around the wire and caused a "heavy ground." The hot sun followed the showers, dried the twigs sufficiently to stop the interference, and the trouble would be reported as remedied. The next rain would again interrupt communication. At last a force of expert linemen were sent out to solve the mystery. It required eight days to discover the trouble, and the little twig cost the company $100 and much complaint.

VISITING EDUCATORS.—Thousands of applications are being made by teachers in all parts of England who want to take part in the excursions to the United States being arranged for the coming autumn and winter. The offices of Mr. Alfred Mosely, who is making the arrangements in this country, are daily besieged by applicants. Unfortunately, only comparatively few of those who desire to go can be accepted. Unless something arises making it possible to send a greater number, about 500 teachers, representing every class, from kindergarten instructors to professors of England's greatest universities, will be included in the tours. The first party, numbering about thirty, will sail for America Nov. 30, and from then until the end of March similar parties will sail weekly. While Mr. Mosely is looking after the preliminary arrangements, Dr. Maxwell, Superintendent of Public Schools of Greater New York, and President Nicholas Murray Butler, of Columbia University, are arranging for the reception and tours of the visitors. Mr. Mosely will sail for New York October 10 to assist in the preparations. Great interest is being shown in the technical and engineering education given in this country.

A RATE FOR CHURCHES.—The Boston Edison Company is making a special rate for current for churches. A recent item in its bulletin, the *Edison Light,* says: "The church rate is the simplest of the rates of the Edison Company. It is made so because it is partly a charity rate, not dependent upon the cost. The church rate is 13 cents for one kilowatt-hour per unit consumed. A church wishing this rate merely signs an application and gives proper notice that it is entitled to the church rate. The rule of the company is to give the church rate only to property used for church purposes and free from taxation under the general statutes. The Edison Company does not attempt to determine what is a church, but accepts the assessor's judgment; if the assessor exempts a building from taxation on the ground that it is a church, then the Edison Company is willing to extend to it the church rate. The minimum charge is $1 per month, but if a church is to be closed, the electricity, and this minimum charge, can be cut off upon the giving of ten days' notice. When the church is reopened there will be no charge for reconnection. If any church entitled to the church rate is not getting it, request is made that notification be given. It is not the wish of the company to charge anyone more than the established rate.

SUBSTITUTE FOR RUBBER.—Reports from Mexico are to the effect that there is an active development of guayule rubber properties. For many years guayule was known to contain rubber, but it is only within a short time that a process has been invented for the extraction of the gum for commercial use. Although the product was of an inferior quality and of little value, it was enough to set chemists and inventors to work on the problem. However, none of the methods have yet attained a degree of perfection, as the known results vary from 10 to 12 per cent, whereas the quantity of gum contained in the shrub is known to be approximately 18 per cent. The quality attained can better be judged by the price realized for the product of the different processes, which varies from 28 to 50 cents, gold, per pound on the New York market. A sample lot of excellent quality, extracted with a process in the experimental stage and not yet patented, brought $1, gold, per pound. No claim is made that the gum extracted from the guayule will ever take the place of rubber, but it can be made a substitute in many forms of manufacture. This industry has now passed from the experimental to the practical stage, and is destined to become a very important one in northern Mexico, especially in the State of Coahuila. Factories which are already working and those now under construction within a small radius of Saltillo will represent an outlay in buildings and machinery alone of several millions of dollars. Large quantities of the gum extracted are now being exported from this district.

TRAVEL IN NEW YORK CITY.—The cash fares received by the lines in all five boroughs for the months of April, May and June numbered 332,384,850, an increase of 29,925,163, as compared with the corresponding quarter of 1905, and representing an average of 3,652,580 cash passengers a day, or 328,848 more a day than the average for the June 30 quarter of last year. The subway carried 37,161,607 cash passengers in the three months, against 26,942,295 in the corresponding period last year; and the elevated lines 69,164,266, against 65,551,703 in April, May and June, 1905; while the Metropolitan system carried 101,971,383, comparing with 99,059,455 a year ago. The total number of cash passengers carried by the elevated, subway and surface lines of the Borough of Manhattan was 208,297,256, an increase of 17,743,803, or 9.3 per cent. The Brooklyn Rapid Transit Company carried in the quarter 96,275,361 passengers, against 88,574,789 a year ago.

CHICAGO CITY LIGHTING.—In a comment upon the dismal showing of the municipal electric light plant of Chicago, the Norwich, Conn., *Bulletin* says: "The city of Chicago has been doing municipal lighting for 18 years, and the city electrician figures out that the enterprise has saved the city a third of a million dollars—a profit of less than $25,000 a year. The *Bulletin* hopes it has, but this showing is not obtained by concealing losses or juggling accounts. It includes the interest upon the total cost paid out of the lighting plant's earnings, not out of the general tax fund; and the statement also includes as items $85,784 lost in taxes the first 13 years and $323,805 lost in taxes in the past five years, a total of $409,589 which is honestly set against the earnings of the municipal lighting plant. That is square. Why should the interest of the old construction bonds of the Norwich water works and the purchase bonds of the Norwich municipal gas and electric plant be paid out of the general tax to-day? It is the political way of doing things in New England cities; and it was only the other day that an expert accountant at Newburyport, Mass., called attention to such business irregularities as these, advised new methods of accounting and a straight business way of meeting interest and making repairs."

AMATEUR ELECTRICIANS KILLED.—A most distressful fatality is recorded in the following dispatch from New Rochelle, N. Y., of August 10: "While experimenting this afternoon with an amateur telegraph line in Rochelle Park, a residence section of New Rochelle, Ditmar Barrett, the sixteen-year-old son of Nathan Barrett, the landscape artist, was killed almost instantly by a shock of electricity, which knocked him from a pole fifty feet high. Another boy was badly stunned and had a narrow escape. Recently the boys of the park formed an amateur telegraph company, and it is said that they obtained permission from the Westchester Lighting Company to string their wires on the electric light poles. There were about a dozen boys in the company and the plan was to make each a subscriber and install a telegraph instrument in his house, so he could talk to the other boys. Young Barrett, because of his superior knowledge of electricity, was made president of the company, and he also acted as boss lineman. The boys were attempting to run a line into the home of Marc Klaw, Jr. Barrett was up the pole in front of the Klaw villa attempting to attach a copper wire to an insulator when the wire accidently came in contact with an uninsulated section of electric light wire carrying a day current at about 2,000 volts. The shock burned his hands and legs terribly and with a shriek he fell from the pole. He landed on his head and his neck was broken."

FOGHORN AND WIRELESS.—A curious story of an effort to put the wireless telegraph out of business by means of foghorns is told in the following dispatch from Chicago of August 9: "Someone with great ingenuity furnished a wonderful scheme to put the wireless telegraph gambling boat, the City of Traverse, out of commission yesterday. The idea was to eliminate the wireless communication with the craft, depriving it of race results by sounding a huge fog horn, of which the vibrations would 'blur' the wireless message. The results were grotesquely disastrous. The gamblers laughed at the police in the tug Andy. The life-saving crews from Jackson Park and South Chicago, believing the sounds to be distress signals, hurried to the Hyde Park crib; sailboats, launches, motor-boats, and an armada of small craft rushed to the rescue, while the shore from Kenwood to South Chicago were lined with persons fearing an excursion boat disaster. Chief of Police Collins denied knowledge of any plans for a marine raid upon the City of Traverse, and stated that if there were police in the tug Andy they were from some outlying station, and were experimenting without his knowledge. The Smith-Perry-White syndicate, which operates the boat charges the scheme up to "Mont." Tennes, their jealous rival. No difficulty with the wireless apparatus was found on board the Traverse, according to employees of the boat and patrons on board. The messages of the race results came without mishap and with regularity, they said. The chief inconvenience suffered was the blatant noise sounded from the foghorn of the Andy, which hovered close to the side of the larger boat all afternoon, and made the deck of the ship a bedlam."

KELVIN ON RADIUM.—In a recent letter to the London *Times,* Lord Kelvin has expressed himself freely concerning recent discussions before the British Association on radium and helium. He protests against the inference that helium may be produced from radium and also against the idea of the gradual evolution of one metal from another. He also expresses himself as against the hypothesis that the heat of the sun of the earth is due to radium; he believes it to be mainly due to gravitation. Prof. Henry E. Armstrong vigorously supports Lord Kelvin's protest against the proposition submitted to the British Association that the production of helium from radium has established the fact of the gradual evolution of one element into others. Professor Armstrong, in a letter to the *Times,* says: "The thanks of the public are due to Lord Kelvin for his protest against the conclusion being drawn from the evidence at present before us that it is proved that there is a gradual evolution of one element into others. No one has yet handled radium in such quantity or such manner that we can say what it is precisely. That helium can be obtained from radium appears proved, but no proof has yet been given that it is not merely contained in it. There was a time when expression 'scientific caution' meant the highest degree of caution, and it was supposed to be an attribute of workers in science. Workers in the radium school appear to have cast caution to the winds and to have substituted pure imagination for it. Among ourselves we should always be at liberty to postulate the most crack-brained hypotheses, to dream the wildest dreams, as a means of guilding inquiry, but we should not court popularity on such a basis. By so doing we lose all claim to guide public opinion."

NICHTHEROY POWER TRANSMISSION.—The city of Nichtheroy, some 30 miles north of Rio de Janeiro, South America, has given its name to a new electric transmission system for supplying power and light to the towns of Cascatinha and Mage, as well as the title city. Electricity is to be generated by water power and transmitted at 44,000 volts to substations at the cities mentioned. The installation is representative of the most modern engineering. At the main generating station the initial equipment will comprise three, three-phase revolving field, 2,000 kilowatt generators built by the General Electric Company. These machines, as well as two 75-kw exciter sets, will be driven by water-wheels made by J. M. Voith & Company, of Wurtemburg, Germany. The excitation current for the main generators will be furnished at 220 volts, the generator voltage being 2,300. This voltage will be stepped up to 44,000 volts in a bank of six water-cooled transformers, each having a capacity of 1,000 kw and operating at 60 cycles. There is to be a spare 1,000-kw transformer and a 3,000-kw generator as a reserve. A very complete switchboard will be installed, all switches as well as rheostats being electrically operated from the board by remote control so that there will be no high tension wiring at the switchboard. From the main generating station, the power is to be delivered over a steel tower line to the three substations named in the foregoing. At the substations the transmission voltage is to be reduced to 6,600 volts for the local delivery. For this purpose there will be four 750-kw transformers at Nichtheroy and four 350-kw transformers at each of the other stations, Cascatinha and Mage. In each station, one of the four transformers will be installed as a reserve.

Electric Power in the P. R. R. Shops at Altoona, Pa.

By Wait Reynolds Loveless.

A STRIKING instance of the increasing use of electric power may be found in the shops of the Pennsylvania Railroad Company at Altoona, Pa., which is one of the largest and best equipped railroad shops in the world. During the past eight years the system of belt-drive from the steam engine, has been gradually replaced by the electric motor-drive, and, at the present time there are about 8,500 hp of motors in service as against less than ten per cent of that amount of steam engine power driving machinery direct.

The first electric motor used in these shops was installed in 1889 for driving an exhaust fan, followed by motors in traveling cranes in 1890. During the year 1899, the first stationary motor was installed to drive a machine tool. This was a 10-hp constant-speed motor geared to a cold saw, and is still in successful operation. The number of motors in service gradually increased from that time on, and at present there are 376 stationary motors and 285 motors on electric cranes and hoists, making a total of 661 electric motors, which range in size from ⅙ to 85 hp.

There are five distinct groups of shops at Altoona, each group having an individual power plant. This is necessary, as direct current is used by four groups and the distance prohibits transmission at the low voltage employed.

Direct current is generated at the machine shop, Juniata shop, South Altoona and East Altoona power plants, the voltage being 230 in each case. At the car shop power plant alternating current alone is generated at 2,200 volts.

The power plant at the machine shops is equipped with three 300-kw generators direct-connected to cross-compound, non-condensing engines, and operate at 230 volts. One of these units is to be replaced in the near future by a 500-kw set, an increase made necessary by the erection of new shops. There are also in the power plant one Brush arc generator belted to a Westinghouse engine and one Thomson-Houston arc generator belted to a 40-hp electric motor, which are used for lighting the shop yards. The switchboard is of slate, being equipped with two sets of bus-bars. There are eleven panels, four for the generator circuits, four for power circuits and three for series arc-lighting circuits. Each of three of the generator panels contains a circuit-breaker, ammeter and double-throw switch for connecting to either of the two sets of bus-bars. The fourth panel contains two ammeters connected into the bus-bars to give the total load. Each of the power circuit panels contain switches and ammeters for four circuits, giving sixteen circuits for use to different parts of the shop. Of these circuits two are arranged to carry either alternating or direct current, the former being obtained from the car shop power plant and used for lighting and testing purposes. The panels for the series lighting service contain eleven circuits, both direct and alternating, to which are connected 22 loops of arc lamps and each circuit is equipped with an ammeter.

With a few exceptions all circuits are led from the power plant through a wire tower and are carried for about 600 ft. on supports built above an outdoor crane runway, and circuits are led from the power lines to buildings on either side. At the end of the crane runway the lines branch off to two pole lines, one running east through the railroad yards and the other extending west about 800 ft. to the end of the shop yard. The supports carrying the lines over the runway have 72 wires on them.

The power plant at the car shops contains four 250-kw generators, each direct-connected to tandem-compound, non-condensing engines, and one 625-kw generator direct-connected to a cross-compound non-condensing engine. These generators are all of the revolving-field type and generate two-phase alternating currents at 60 cycles and 2,200 volts. Each generator has its own exciter, those of the smaller sets being geared to the main shaft. The excitation for the large generator is obtained from a 20-kw generator driven by a 30-hp, 2,200-volt induction motor. This exciter set is connected so that it may be used on any of the other generators in emergency. There are also installed at this plant twelve constant-current transformers of 75 lights capacity at 7.5 amp. These are used for lighting the shops and railroad yards.

FIG. 2.—LINES LEAVING WIRE TOWER, MACHINE SHOP POWER PLANT.

The main switchboard is built of slate and contains 13 panels and carries two sets of bus-bars. Five panels are used for the generators, one for the exciter set for the large generator, one panel for ground detector and recording voltmeters and the remainder for the distributing circuits. Each generator panel is equipped with two double-pole, double-throw oil switches, two ammeters and synchronizing lamps. In addition there are voltmeters for each phase on the two sets of bus-bars and four ground detectors, two for each set of bus-bars. The voltage regulation is accomplished by means of a Tirrill automatic regulator. Until recently all high-tension lines were carried from this plant on poles, but the wires are now being placed underground and in the near future the conduit system will be used entirely.

Figs. 1 and 3.—Interior Views of South Altoona Power Plant, and Machine Shop Power Plant.

At the Juniata shop power plant there are three 200-kw generators to which will soon be added a 300-kw set. The generators are direct-connected to non-condensing, cross-compound engines and operate at 230 volts. The switchboard contains six panels and is very similar to that at the machine shop plant, with the exception that it is supplied with two station watt-hour meters which record the total energy generated at the plant. The wires are led from the building through a wire tower back of the switchboard and carried on poles up and down the yard between the shops. This plant as yet only furnishes power for the shops, the lighting being furnished from the car shop plant.

At East Altoona there are two 100-kw direct-connected sets, which generate direct current at 230 volts. The switchboard contains two generator panels and two panels for the power circuits, the wires all being run underground to the different shops.

The power plant at the new South Altoona foundries is the largest of the company's plants in Altoona. There are eight 350-hp boilers in four batteries equipped with Roney automatic stokers. A coal crusher and coal and ash conveyor, each driven by a 10-hp compound-wound motor, crush and convey to the bunkers 35 tons of coal per hour. The generating equipment consists of two 500-kw and two 300-kw generators, direct-connected to non-condensing, cross-compound Corliss engines; also one 50-kw generator direct-connected to a non-condensing high-speed engine—all generators furnishing direct current at 230 volts. The switchboard consists of five generator panels, five feeder panels and one fire alarm panel. The generator panels contain the usual switches, circuit-breakers, ammeters, etc., and at the back of each panel there is a Thomson watt-hour meter. Each feeder panel contains switches and ammeters for four circuits, making a total of 20 circuits. All wires are led from the plant through an underground tunnel which branches off to each of the main buildings. Inside the buildings all mains are run open, while small branches are run in conduit.

The total rated capacity of the generators in the five power plants amounts to about 5,000 kw, and the average daily load may be judged from the load curves shown in Fig. 4.

Where the old engine-drive was replaced by electric motors, the existing conditions were changed very little. Machines of the same kind were, to a large extent, grouped together, and as there was no need to disturb this system, in the case of the small machines the main shafting was divided into sections and belted to motors of the proper size, usually placed on overhead supports. As new machines were added to the various groups, care was taken that the motor was not overloaded, it being replaced by one of larger capacity when the load warranted so doing. It has been the experience that better satisfaction in regard to both expense and shut-downs, is obtained by not allowing the average load to go beyond the manufacturer's rating of the motor, for with groups of small machine tools the average load is usually less than one-half the maximum, and, this maximum load occurs frequently and is of long enough duration to have a bad effect on a motor which is normally carrying about full load. Most of the larger tools, chiefly planers, boring mills, lathes, etc., were equipped with individual motors. In some places, notably with planers, these were simply belted to the counter-shaft, but more often the motor was geared directly to the machine.

As new machines have been added to the equipment of the shops, the individual drive has been largely used, and at present there are four motors connected singly to each motor driving a group. Individual motors are applied to practically every type of machine in use in the shops, and range in size from ½ to 80 hp, although tools requiring less than 3 hp are belted to groups wherever it is possible to do so. Naturally a large variation in speed is required in most cases of individual drive, and each motor is equipped with either a controller or rheostat in the field circuit, the latter being used only when the required speed ratio is not more than from 3 or 2 to 1.

The largest motor required for individual work is rated at 80 hp. This is used on a 72-in. by 72-in. by 36-ft. planer and is worked well up to its capacity. There is also a 5-hp motor on the planer for raising and lowering the tool post, and the reversing gear is equipped with an automatic magnetic clutch.

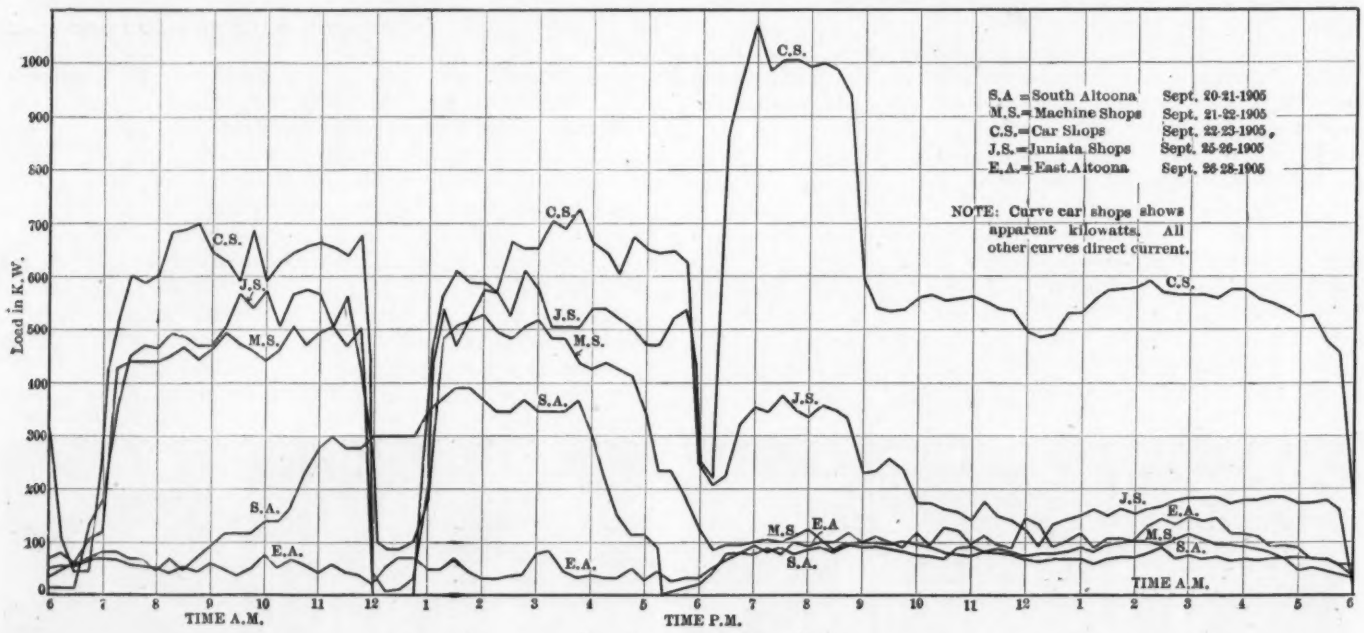


Fig. 4.—Load Curves.

Among the other heavier machines there are two 90-in. wheel lathes equipped with 30-hp variable-speed motors, and six 90-in. lathes taking 20-hp motors. These lathes are designed for heavy cuts and high cutting speed, using the full power of the motor. A test of one of the lathes equipped with a 30-hp motor gave the following results. The cut was made on the steel tires of a pair of 56-in. engine driving wheels:

Size of cut	7/16 in. x 7/32 in.
Number of cuts	2
Cutting speed	13.3 ft. per min.
Metal removed	30.6 cu. in. per min.
Power delivered to motor	28.9 hp.

Another test with the same material made on a 72-in. lathe, driven by a 25-hp motor, gave the following results:

Size of cut	7/16 in. x 3/16 in.
Number of cuts	2
Cutting speed	11 ft. per min.
Metal removed	21.6 cu. in. per min.
Power delivered to motor	27 hp.

These machines are used for turning down tires on old wheels and require a wide range of speed on account of the hard spots which are often encountered and which must be cut at a very low rate. The controller is placed convenient to the operator, so that he can handle it without taking his attention from his work.

A 30-in. by 18-ft. engine lathe is geared to a 15-hp variable-speed motor and in this case the controller handle is mounted on the movable tool carriage and is connected to the controller by means of a bevel gear which slides on a shaft running the length of the lathe. This is the most convenient form of controller mounting in use in the shops, as the handle is always directly in front of the operator.

There are two large gang milling machines which are each driven by a 25-hp and a 10-hp motor. The larger motor drives

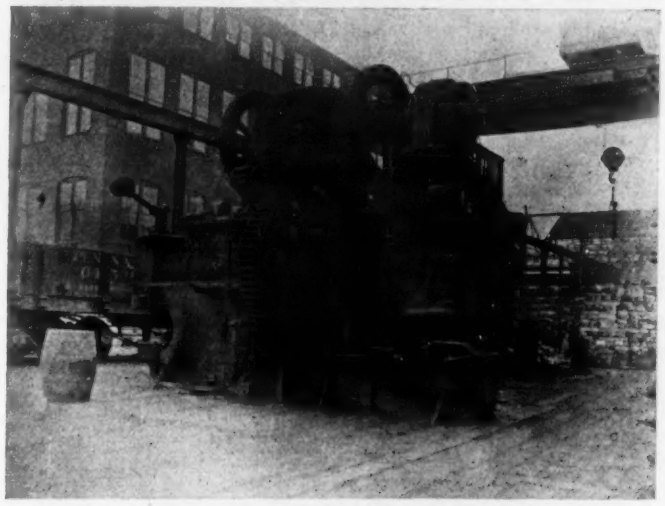


FIG. 5.—COMBINATION PUNCH AND SHEAR DRIVEN BY 25-H.P. COMPOUND-WOUND MOTOR.

the cutter shaft and the smaller motor operates the feed. These machines will remove 10 cu. in. of steel per minute with a load on the motor of 21.8 hp and 7.6 hp, respectively. Two double-headed slotters with 5-ft. by 45-ft. beds are driven by 10-hp motors at each head. The slotter moves lengthwise of the bed and a motor is bolted directly to the body and gear connected. Current for the motors is taken by trolleys from overhead wires. A double-headed drill for spacing holes in driving rods is driven by a 5-hp motor connected to each head by means of chain belt. The pump on a 100-ton hydraulic jack is driven by a 5-hp motor mounted on the pump base and gear-connected. A 10-spindle drill is geared to a 10-hp motor. This takes about 6.5 hp when drilling 1 9/16-in. holes in cast iron.

In the metal yard is a combination punch and shear driven by a

FIG. 6.—ELECTRIC CRANES IN SOFT IRON FOUNDRY.

25-hp compound-wound motor mounted on the machine and connected by chain belt to the shaft. This machine will shear 16 sq. in. of steel and punch holes in 2-in. steel plate. There is also a bolt shear geared to a 10-hp compound-wound motor mounted on the base of the machine. This shear is used for cutting bars up to a diameter of 2½ in. A machine for threading pipe up to 12 in. in diameter is geared to a 5-hp motor and equipped with a field rheostat for speed regulation.

In the pattern shop there are numerous small machines direct-connected to motors. Three band saws are each geared to 5-hp motors; three small circular saws are driven by 5-hp motors connected by belt; two buzz planers are each belted to 5-hp motors and a larger planer is driven by a 10-hp motor. A lathe capable of turning to a diameter of 8 ft. is belted to a 5-hp motor. All of the foregoing motors are enclosed to keep them free from dust, and the effective power is thus considerably less than the ratings given. A 20-hp motor drives a line shaft to which are

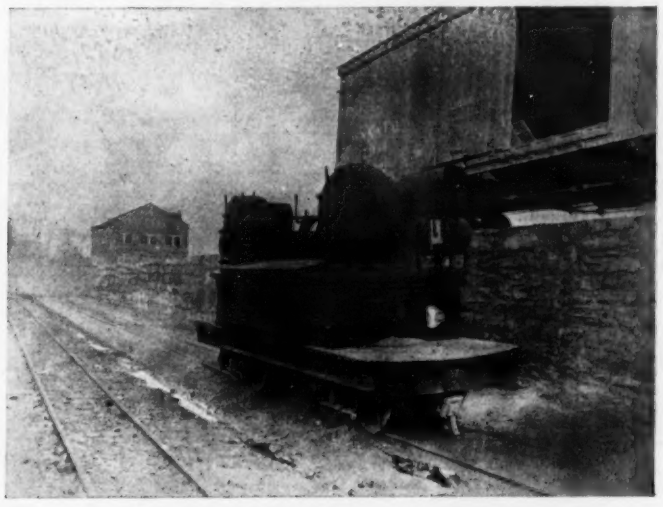


FIG. 7.—STORAGE BATTERY LOCOMOTIVE FOR HAULING SAND CARS.

connected several small lathes, a grindstone, a saw sharpener and other small machines.

In the foundry motors are used to drive casting shakers, sand sifters and mixers, and a belt system for conveying sand to bunkers above the moulding machines. A small storage battery locomotive is used to haul dump cars for conveying sand, ashes, etc., to and from the foundry.

At the car shops two-phase induction motors are used, which run at constant speed. All speed variation is obtained by means of cone pulleys or change of gears, but as the greater part of the machinery is for wood-working purposes, where a speed variation is not required, the inconvenience of this is slight. The metal-working machinery is similar to that already described and takes approximately the same size motors, though the individual drive is not employed as extensively as in the other shops

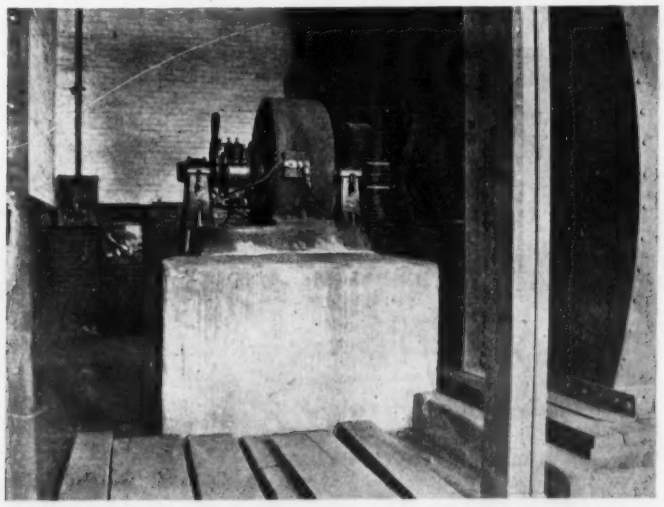


FIG. 8.—HEATING FAN GEARED TO 30-H.P. MOTOR.

where direct current is used. In the lumber mill and cabinet shop, however, there are a number of heavy machines driven by separate motors. A four-headed timber planer is belted to a 50-hp motor. This machine will surface four sides of 12-in. by 16-in. timbers and make a cut of 13 sq. in. of wood at the rate of 40 ft. per minute. A 4-in. band saw for cutting timbers up to 12 in. in thickness is driven by a 30-hp motor, and a 66-in. surface planer requires a 20-hp motor. Three circular saws for

light work are driven by a 10-hp motor and a small band saw is driven by a 5-hp motor. Several wood-carving machines are driven by 2-hp motors, and in the upholstering department a number of 1-hp and ½-hp motors are used to drive sewing machines. Also three large sanding machines are each belted to 10-hp motors.

One very important use to which motors are put in the shops is that of driving fans. There are in service 46 fans used for furnishing air blast, heating purposes, ventilating and for removing dust, wood shavings, etc. These are driven by motors, the total capacity of which is 1,340 hp.

A partial list of motors used for individual and group drive, not mentioned heretofore, is given below:

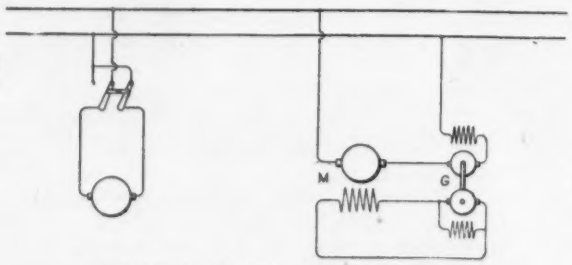
3 planers, 36 x 36-in. x 10-ft., driven by 20-hp motor.
1 duplex milling machine, 14-ft. table, driven by 20-hp motor.
1 bending roll, driven by 22-hp motor.
1 Sturtevant blast fan, driven by a 40-hp motor.
5 planers, 5-ft. table, driven by 10-hp motor.
11 drill presses, driven by 10-hp motor.
2 wheel-boring mills and 1 drill press, driven by 10-hp motor.
1 milling machine, 6-ft. table, driven by 15-hp motor.
9 lathes, about 18-in x 7½-ft., driven by 20-hp motor.
8 boring mills for driving wheel boxes, driven by 20-hp motor.
4 planers, 5-ft. table; 2 slotters, 22-in. stroke and 2 turret lathes, driven by a 20-hp motor.
18 bolt-threading machines, driven by 20-hp motor.
15 lathes, about 18-in x 6-ft., driven by 20-hp motor.
8 belt hammers, driven by 50-hp motor.
15 bolt lathes and bolt-threading machines, driven by 30-hp motor.
3 mortise machines and 4 drill presses for wood working, driven by a 10-hp motor.
2 circular saws, 1 planer and 2 drill presses for wood working, driven by a 7½-hp motor.
1 4-head flooring surfacer, driven by a 20-hp motor.

In wiring motors the Underwriters' rules are closely followed, and every precaution is taken to minimize the fire risks. The mains are run open through the building, but the wires from the mains to the motor switchboard are run in iron conduit, carried down the side walls and under the floor, thus avoiding any vertical wires which would interfere with the operation of cranes or hoists. From the switchboard to the motor the wires are placed in flexible conduit if the motor is close at hand, or in solid iron conduit if it is some distance away. The switchboards are made in standard sizes to carry switch, starting rheostat and fuse block or circuit-breaker. They are built three-ply, 1½ in. thick, of well-seasoned poplar and are shellaced and painted black. Motors which are operated out of doors are covered with sheet-iron housings to protect them from the weather, and the switchboards are enclosed in wooden boxes.

A complete record is kept of each motor on a printed form, which gives the size, manufacturer's rating and specification, number of motor and of armature, date of purchase, date first put in service, department and machine for which motor is used, size of brushes and a record of all repairs and changes made on the motor. This information has proved to be of great value, especially in ordering spare parts, material for repairs and new motors, and also in comparing the merits of various motors. A similar record is kept of generators and transformers.

Distant Control of Electric Motors.

In the operation of electrically-driven valves in ship-steering gear and the like, it is desirable to locate the motor at one point and its controlling mechanism at a point distant therefrom. A patent issued July 31, to Mr. H. F. Parshall describes a method by which the direction of rotation of the motor may



DISTANT CONTROL OF ELECTRIC MOTORS.

be reversed by simply reversing the direction of current in the supply mains. The inventor employs a separately-excited motor *M*, in which the direction of rotation depends upon the direction of current through the armature and in which the field-coils are excited by a small motor-generator *G*, whose direction of rotation is independent of the direction of current and which consists of a motor of the series type driving a small exciting-generator. Thus a movement of the reversing switch will cause a reversal of current in the armature of the motor without a corresponding reversal in the field coils, and the direction of rotation will be accordingly changed.

Magnetic Field in the Single-Phase Induction Motor.

By A. S. McAllister.

As is well known, when the circuits of a polyphase induction motor operating near synchronism are so arranged as to convert the machine into a single-phase motor, the revolving field, which was previously due to the combined actions of certain components of the displaced polyphase currents, continues to exist, and the action of the machine in developing mechanical power is subjected to almost no change. It is equally well known that the quadrature "speed" component of the magnetic field is produced by current in the secondary, and that the magnetomotive force represented by this secondary current must be supplied by a component of primary current. On account of the fact that the secondary current which produces the quadrature "speed field" occupies a position in space such that it cannot possibly react directly on the field produced by the primary current, it is

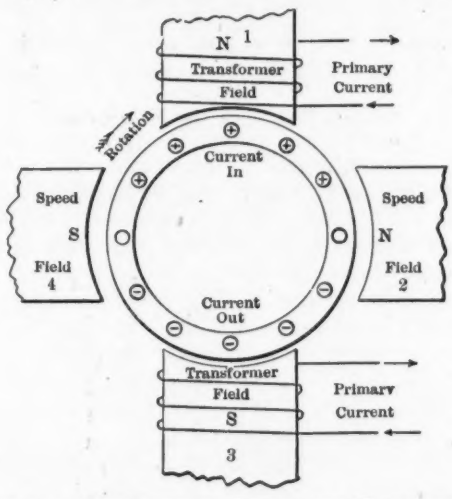


FIG. I.—PRODUCTION OF "SPEED FIELD" CURRENT.

not immediately apparent in what manner the "quadrature watts" for the "speed field" are supplied by the primary exciting magnetomotive force.

A popular method of treating the internal behavior of a single-phase induction motor is the one due to Ferraris, who showed that the simple alternating field can, in all of its effects, be replaced by two revolving fields moving in opposite directions, the maximum value of each being equal to one-half of the maximum value of the alternating field. By means of this method it is possible to ascertain the distribution of current in the secondary, and the reaction of certain components of the secondary current upon the primary, but the present writer believes that the actual significance of the results obtained, as viewed by the average reader, are greatly obscured by the difficulty in distinguishing the imaginary from the real when the two are so closely interwoven.

A prominent writer of the present day states that "the cause of the cross magnetization in the single-phase induction motor near synchronism, is that the induced armature currents lag 90° behind the inducing magnetism and are carried by the synchronous rotation 90° in space before reaching their maximum"; and that "below synchronism the induced armature currents are carried less than 90°, and thus the cross magnetization due to them is correspondingly reduced, and becomes zero at standstill." It is greatly to be doubted if these statements convey any physical idea whatever to a mind not already thoroughly familiar with the facts.

Although the method outlined below will not serve to present

any facts which cannot be ascertained by other methods which have frequently been employed, yet it is believed that much good can be accomplished by drawing attention to the fact that all of the phenomena connected with the production of the magnetic field in the single-phase induction motor can be investigated with the utmost simplicity by dealing directly with well-known electromagnetic relations without resorting to imaginary physical or mathematical representations.

Fig. 1 shows a two-pole model of a single-phase induction motor which is represented as possessing four mechanical poles, two of which (1 and 3) are excited by single-phase alternating current. Merely for sake of simplicity in explanation, mechanical poles 2 and 4 are indicated as subjected exclusively to the flux of the "speed field." Under any condition of operation the flux in poles 1 and 3 is determined directly by the primary e.m.f., modified by the volts consumed in the local impedance of the primary coil by the current which flows therethrough. That is to say, the flux in these poles follows the laws which relate to stationary transformers; no action which takes place in the secondary can rob the primary of this transformer feature. In dealing with the secondary, however, it is necessary to recognize the fact that each rotor conductor is subjected to four distinct electromotive forces—the e.m.f's produced by the rate of change of the transformer and of the speed fields, and the e.m.f's generated by the motion of the rotor through the transformer and the speed fields. Each of these e.m.f's will be treated separately and the combined effects will then be investigated.

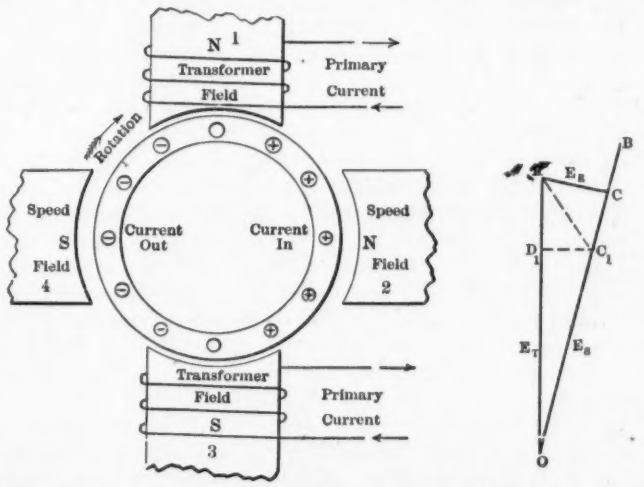
When the rotor is moving across the transformer field in the direction indicated, there will be generated in each of the conductors under the poles an e.m.f. proportional to the product, of the field magnetism and the speed of the rotor. Evidently if the speed be constant, of whatsoever value, this e.m.f. will vary directly with the strength of magnetism; that is, it will be maximum when the magnetism is maximum, and zero at zero magnetism. Other conditions remaining the same, the maximum value of this secondary e.m.f. will vary directly with the speed of the rotor.

If the circuits of the rotor conductors be closed, there will tend to flow therein currents of strengths depending directly upon the e.m.f's generated in the conductors at that instant and inversely upon the impedance of the rotor conductors. The current which flows through the rotor circuits at once produces a magnetic flux which by its rate of change in value generates in the rotor conductors a counter e.m.f. opposing the e.m.f. that causes the current to flow, and of such a value that the difference between it and this e.m.f. is just sufficient to cause to flow through the "local" impedance of the conductors a current whose magnetomotive force equals that necessary to drive the required lines of magnetism through the reluctance of their paths. Since this latter magnetism must have a rate of change equal (approximately) to the e.m.f. generated in the rotor conductors by their motion across the primary field, and since this e.m.f. is in time phase with the primary field, it follows that this magnetism must have a value proportional to the rate of change of the primary magnetism; that is, it is (approximately) in time quadrature to the primary magnetism.

A study of the direction of the currents in the rotor under the conditions assumed will show that when a north pole at 1 (in Fig. 1) has reached its maximum value and is decreasing towards zero, the speed field is building up with a north pole at 2, and that this pole continues to increase in strength until the magnetism at 1 reverses its direction. Thus, it may be stated that the north pole of the resultant magnetism travels in the direction of motion of the rotor. Since the rapidity of reversal in sign of the "transformer field" poles and of the "speed field" poles depends solely upon the frequency, it may be stated that the resultant field revolves at synchronous speed. The "speed field" is equal (approximately) to the product of the "transformer field" and the speed, with synchronism as unity. Thus the resultant field is at any speed elliptical as to electrical space representation; one axis of the ellipse is determined by the "transformer field," while the other depends upon the speed. At synchronism the ellipse becomes a circle; above synchronism the ellipse has its major axis along the "speed field"; at zero speed the ellipse is a straight line, which means that at standstill there is no "space" quadrature flux and hence no revolving field.

Reviewing the electromagnetic processes just discussed, it will be noted that the e.m.f. which produces the "speed field" current is caused by the motion of the rotor through the "transformer field" and is opposed by the rate of change of the "speed field" through the rotor circuits. The mechanical position of the "speed field" current with reference to the primary coil prevents it from reacting directly on the "transformer field." It remains to investigate the effect of the e.m.f's generated in the secondary by the rate of change of the "transformer field" through the rotor conductors and by the motion of the rotor conductors through the "speed field." It will be noted at once that a current due to either of these e.m.f's would be in position to tend to affect the "transformer field."

Referring now to Fig. 2, assume initially for sake of simplicity that the rotor revolves at absolutely synchronous speed (being driven by some external means). As noted above, the transformer e.m.f. of the "speed field" in the rotor is *slightly less* than the speed e.m.f. of the "transformer field," and is out of time phase therewith, by an amount equal to the e.m.f. necessary to cause the "speed field" current to flow through the "local" impedance of the rotor conductors. It is seen at once, therefore, that the speed e.m.f. of the "speed field" in the rotor differs from the transformer e.m.f. of the "transformer field" by an *exactly* equal amount, so that a current *exactly equal* to the "speed field" current is produced in the rotor in an electrical space position such that its magnetomotive force tends directly to affect the "transformer field." Since the "transformer field" must have the



FIGS. 2 AND 3.—PRODUCTION OF TRANSFORMER SECONDARY CURRENTS AND ELECTROMOTIVE FORCES.

value demanded by the primary e.m.f., a current equal in magnetomotive force and opposite in direction to this component of the secondary current must flow in the primary coil. As indicated in Fig. 2, and as may be verified by a study of the fluxes and currents, this component of the secondary current has a time phase position to tend to *decrease* the "transformer field," so that the opposing current in the primary appears as an added component of the primary exciting current. Thus the "speed field" current is accurately represented in the exciting magnetomotive force supplied by the primary current.

It is interesting to note that the "added" component of the primary exciting current depends upon the reluctance of the path taken by the flux of the "speed field"; when the air-gap traversed by the "speed field" is much greater than that through which the "transformer field" passes (as shown in Figs. 1 and 2) the "added" component is likewise much greater than the true primary "transformer" exciting current. Thus, the total quadrature exciting watts are equal to the *sum* of the watts which would be required for producing the same magnetic field by means of two-phase currents in coils wound symmetrically on poles 1, 2, 3 and 4, and not necessarily equal to twice the value initially taken by the windings on poles 1 and 3.

It is instructive to investigate the conditions which would exist if the two components of secondary current at synchronous speed could be caused to continue to flow unaltered with the primary on open circuit. As noted above, the "speed field" current and that component of the secondary current which tends to oppose

the transformer field flow in "electrical time quadrature" and occupy positions in "electrical space quadrature"; thus, if acting without opposition, they would produce a rotating magnetic field. It is a curious fact, easily appreciated from a study of Figs. 1 and 2, that this magnetic field would travel around the air-gap in a direction opposite to the motion of the rotor. Since the two exciting components of the secondary current in reality combine in the rotor structure to produce a resultant single current distributed throughout the several conductors, it may be stated that a band of secondary exciting current revolves synchronously in a negative direction. If one considers the time value of the current in a single rotor conductor, he will discover that at synchronous speed this current is of double frequency. As will be shown below, at other speeds the "secondary exciting current" has a value proportional (approximately) to the speed, and it continues to revolve synchronously in a negative direction; thus the frequency of this current in an individual rotor conductor is equal to the primary frequency, f_p, multiplied by one plus the speed, S, with synchronism as unity. That is, $f_s = f_p\ (1 + S)$.

Consider now the effect of operating the rotor at a speed somewhat below synchronism. Since there is no opposing magnetomotive force in line with the "speed field," the "speed field" component of the rotor current acts as though it alone occupied the secondary conductors, and its value is in no way affected by the presence of any other component of secondary current. Thus, the e.m.f. necessary to force the "speed field" current through the secondary conductors depends solely on the value of the "speed field" component of the rotor current. Since the e.m.f. generated in the secondary by the motion of the conductors through the "transformer field" depends directly upon the product of this field and the speed, it follows that a definite percentage of this speed-generated e.m.f. is consumed in the "local" secondary impedance at all speeds, and that the time phase displacement between the speed-generated e.m.f. and the transformer e.m.f. of the "speed field" is constant at all times. Thus, the "speed field" at speed, S, bears to the "transformer field" a ratio equal to the product of S and a certain constant which denotes the difference in value and phase position of the "speed field" and the "transformer field" at exact synchronism. The significance of this statement is that the "speed field" component of the secondary current has a value proportional accurately to the product of the speed, S, the "speed field" current at synchronism and the ratio of the "transformer field" at speed, S, to that at synchronous speed.

Since the transformer e.m.f. of the "transformer" field in the rotor depends upon the strength of this field, but is independent of the rotor speed, while the opposing speed e.m.f. of the "speed field" varies with the product of the speed and the "speed field," it follows that the resultant e.m.f. which tends to produce "power" current in the secondary at speed, S, is equal (approximately) to the product of the quantity $(1 - S^2)$ and the transformer e.m.f. (See Fig. 3.) This component of secondary current occupies at all times a space position magnetically in line with the "transformer field," and it reacts upon the primary just as though it flowed through the secondary of a stationary transformer into a non-inductive (fictitious) load resistance; it is superposed in space, but not in time, upon that component of the "revolving secondary exciting current" which directly opposes the "transformer field."

In Fig. 3 let the line $O\,A$ represent the value of the transformer e.m.f., E_t, of the "transformer field" in the rotor; E_t varies directly with the "transformer field," and hence decreases as the primary current increases. Let the angle $A\,O\,B$ represent the time phase difference between E_t and E_s, the speed e.m.f. of the "speed field" in the rotor; the angle $A\,O\,B$ is constant at all speeds. At synchronous speed, E_s has a value $O\,C$ such that the resultant of E_t and E_s gives the electromotive force, E_r, which produces that component of rotor current which reacts upon the primary. At some lower speed, S, E_s has a value $O\,C_1$, such that $O\,C_1 = S^2\ (O\,C)$, neglecting the relative decrease in the value of E_t, and the resultant electromotive force which produces current to react upon the primary is shown by $A\,C_1$. Of this latter e.m.f. the component, C_1D_1, in time quadrature with the transformer e.m.f., varies with S^2, the square of the speed; (that is, it decreases when S decreases), while the component, $A\,D_1$, in time phase with the transformer e.m.f., varies with $(1 - S^2)$; that is, it increases with decrease of speed. To the latter of these components may be attributed the secondary "load" current, while to the former may be attributed that component of the "negatively revolving exciting current" which directly opposes the "transformer field."

When the rotor is stationary the "load" component of the secondary current in the individual conductors is of the primary frequency; at nearly synchronous speed it pulsates in value in each separate rotor conductor, being unidirectional in certain conductors and alternating at double frequency in certain other conductors situated 90 electrical space degrees from the former.

It is seen, therefore, that there exist in the rotor three components of secondary current, each of the primary frequency with reference to space representation: the "speed field" current, the current having a value closely equal to the product of the "speed field" current, and the speed, but displaced therefrom both in space and in time by 90 electrical degrees, and the load current. Each of these varies in value with the "transformer field." The first varies directly with the speed, S. The electromotive force which produces the second varies with S^2, while the electromotive force which produces the third varies with $(1 - S^2)$. At synchronous speed the first two components are equal in value, while the third is practically zero. At zero speed the first two components are zero and only the third flows in the rotor. Under all conditions the second and third components combine to form the secondary current of the machine considered as a transformer; the second component acts as a continually decreasing (with decrease of speed) wattless current, while the third acts in all respects as though it flowed through the secondary into a non-inductive load resistance.

The relations which exist between the several components of

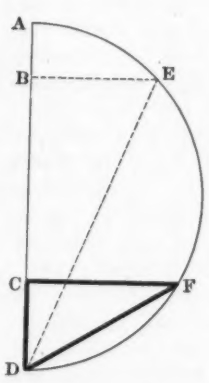


FIG. 4.—NUMERICAL VALUES OF FLUXES, CURRENTS AND E.M.FS.

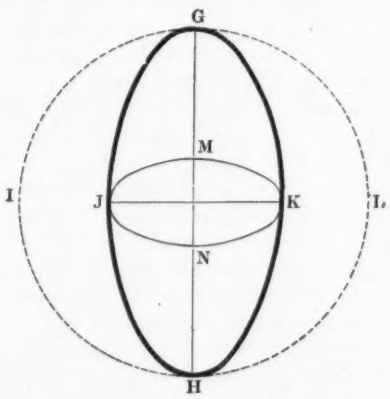


FIG. 5.—TIME AND SPACE VALUES OF FLUXES AND CURRENTS

the fluxes, the currents and the electromotive forces in the rotor at various speeds are shown graphically in Figs. 4 and 5. In Fig. 4, let the distance, $A\ D$, be given an arbitrary value of unity, and let the curve, $A\ E\ F\ D$, be a semi-circle. Then if $D\ E$ is made equal to the speed, S, $B\ D$ is equal to S^2. Consider the condition when the speed, S, has the value represented by $F\ D$; the ratio of the "speed field" to the "transformer field" is shown directly by the line, $F\ D$; this line also shows the ratio of the true "speed-field" current to the true "transformer-field" current, and likewise the ratio of the component of the secondary current which directly opposes the "transformer field" to the true "speed-field" current. Thus, if at the speed shown by $F\ D$, $A\ D$ is assumed equal to the "transformer-field" current, $D\ F$ is equal to the true "speed-field" current and $C\ D$ is equal to the "opposing" component of the secondary current Furthermore, if at the speed, $F\ D$, $A\ D$ be made equal to the e.m.f. which would be produced in the secondary by the "transformer field" with the rotor stationary, $C\ D$ is the actual speed e.m.f. due to the motion through the "speed field," and $A\ C$ is the e.m.f. which causes "load" current to flow through the secondary impedance.

It is to be noted especially that the diagram of Fig. 4 gives only the relative numerical values of the various components and does not indicate their time-phase or electrical space positions. The electrical space and time values of the electro-

motive forces are shown in Fig. 3, while the equivalent values for the fluxes and currents are represented in Fig. 5. In this diagram *G H* is equal to *A D* of Fig. 4, while the curve, *G L H I*, is a circle; *J K* is made equal to *F D* and the curve, *G K H J*, is an ellipse; *M N* is equal to *C D* and curve, *M K N J*, is an ellipse. The electrical space value of the flux at synchronous speed is shown by circle, *G L H I*, while at speed, *D F*, it has the value indicated by ellipse, *G K H J*. If the line, *G H*, shows the value and phase position of the true "transformer-field" current, the line, *J K*, simultaneously shows the value and phase position of the true "speed-field" current; these currents are in separate electrical structures, and they do not combine directly, but their magnetomotive forces combine to produce the elliptical revolving magnetic field. The value and phase position of the "opposing" component of the secondary current is shown by the line, *N M*; this current is in the same electrical structure with current, *J K*, and the two combine to produce the "negatively revolving secondary exciting current," shown by curve, *K M J N*, which is elliptical as to space representation.

It is interesting to observe that the actual "speed field" current in the secondary varies directly with the speed, but that the component of the secondary current which reacts directly upon the transformer field varies with the square of the speed, or, more correctly, with the square of the transformer field. It will be noted that on account of this fact the total "quadrature exciting watts" of the single-phase induction motor vary directly with the square of the "transformer field" plus the square of the "speed field." Thus the true exciting watts of the machine at any speed are directly proportional to the sum of the squares of the densities of the fluxes traversing the several magnetic paths.

For the further discussion of the characteristics of the single-phase induction motor, the reader is referred to an article which appeared in the ELECTRICAL WORLD June 30, 1906.

Magnetizing Currents in Polyphase Induction Motors.

BY R. E. HELLMUND.

SEVERAL publications of late have brought out the fact that the secondary currents of a light-running induction motor tend to influence the rotating field so as to cause an almost sinusoidal distribution of the field over the pole faces, when a sinusoidal e.m.f. is impressed upon the primary. In the following it will be shown that although the secondary reaction has

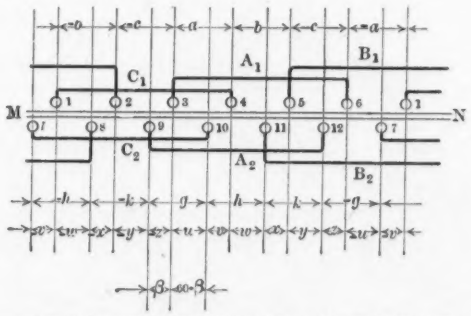


FIG. 1.—ARRANGEMENT OF PRIMARY AND SECONDARY COILS.

such favorable influence on the field distribution, it causes a non-sinusoidal current to flow in the primary winding, when a sinusoidal e.m.f. is impressed upon the primary.

Fig. 1 shows the coil arrangement of a three-phase motor with one slot per pole per phase. The current volume of each slot may be considered to be concentrated into a mathematical point at the pole face. The flux values between the various current points may be designated by letters, as indicated in Fig. 1.

The e.m.f's impressed may be represented as

$E_a = -\sin \alpha$ upon coil *A*,
$E_b = -\sin(\alpha + 120)$ upon coil *B*,
$E_c = -\sin(\alpha + 240)$ upon coil *C*.

From this the counter e.m.f's, which must be induced, follow at once:

$-E_a = \sin \alpha$ in coil *A*,
$-E_b = \sin(\alpha + 120)$ in coil *B*,
$-E_c = \sin(\alpha + 240)$ in coil *C*.

Therefore, the flux threading the coils expressed as a function of the time must be:

$\Phi_a = \cos \alpha$ for coil *A*,
$\Phi_b = \cos(\alpha + 120)$ for coil *B*,
$\Phi_c = \cos(\alpha + 240)$ for coil *C*.

From Fig. 1 it will be noted that

$$\phi_a = a + b + c = \cos \alpha, \text{ etc.},$$

and it follows that

$a = \cos \alpha + \cos(\alpha + 240) = -\cos(\alpha + 120)$,
$b = -\cos(\alpha + 120) - \cos(\alpha + 240) = \cos \alpha$,
$c = \cos \alpha + \cos(\alpha + 120) = -\cos(\alpha + 240)$.

This must be true with or without secondary reaction.

For the open secondary it may be easily shown that in order

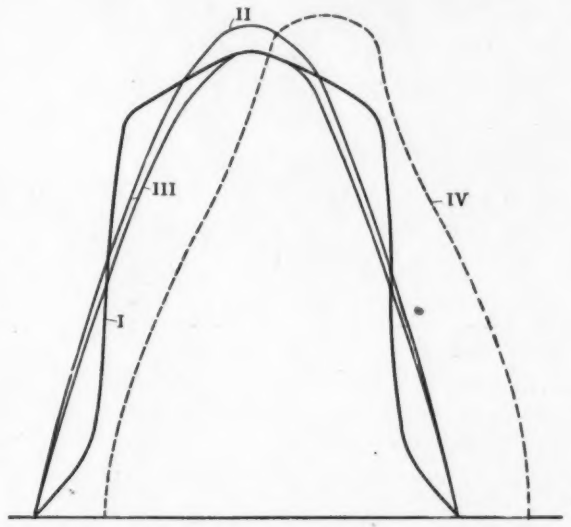


FIG. 2.—CURRENT CURVES FOR X = 0 DEGREES.

to produce the field as given by these equations, the following currents must flow in the primary, if the reluctance of the magnetic part can be assumed to be constant:

$I_{a1} = \cos \alpha$ in coil *A*,
$I_{b1} = \cos(\alpha + 120)$ in coil *B*,
$I_{c1} = \cos(\alpha + 240)$ in coil *C*.

If the secondary is closed, and its resistance is assumed to be zero, the currents in the secondary with the rotor at synchronous speed will so flow that the field threading each secondary coil will be kept constant, and from this it follows that the flux of each particular secondary tooth will be kept constant.

In the case under consideration it is seen that in the moment when the current points, 3 and 9 and 4 and 10, coincide, respectively, the flux,

$g = a = \cos \alpha + \cos(\alpha + 240)$, and is constant.

In the same way the constant values of *h* and *k* may be determined. From Fig. 1 it will be observed that

$$a = u + v,$$
$$h = v + w, \text{ etc.}$$

and therefore:

$$u = \tfrac{1}{2}(a - h + b - k + c + g),$$
$$v = \tfrac{1}{2}(h - b + k - c + a - g), \text{ etc.}$$

At synchronous speed it requires the time β to move the secondary with reference to the primary by the angle β. Now, if $\alpha = x$, when $\beta = 0$, then $\alpha = x + \beta$, when the secondary has the position shown in Fig. 1, and it follows that

$$\beta = \alpha - x.$$

The densities at the various parts of the pole surface are, therefore, per degree:

$$D_u = \frac{1}{60 - \beta} u = \frac{1}{60 - \alpha + x} u,$$

$$D_v = \frac{1}{\beta} v = \frac{1}{\alpha - x} v, \text{ etc.}$$

Moreover, the density is proportional to the sum of the cur-

rents which are flowing around a certain area of the air-gap. Therefore, from Fig. 1:

$$D_u = I_{c1} + I_{a1} + I_{c2} + I_{a2},$$
$$D_v = I_{c1} + I_{a1} + I_{a2}, \text{ etc.}$$

and

$$I_{a1} = D_x - D_y + D_w \text{ and } I_{a2} = D_y - D_x,$$
$$I_{b1} = D_y - D_x \qquad I_{b2} = D_x - D_w,$$
$$I_{c1} = D_v - D_w \qquad I_{c2} = D_u - D_v.$$

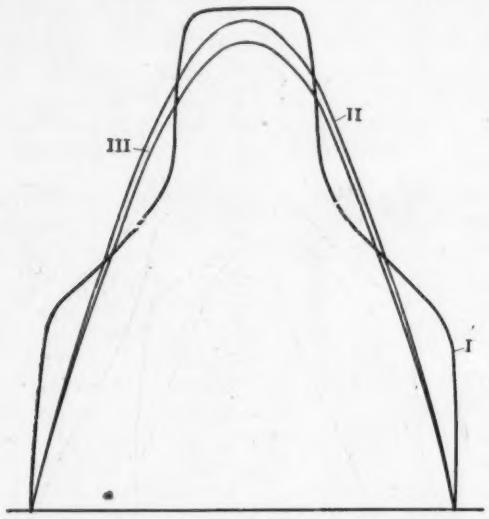


FIG. 3.—CURRENT CURVES FOR X = 30 DEGREES.

The values of D_u and D_v, etc., are known from the above considerations, and the current values may be determined.

In Fig. 2 one of the primary currents is shown by the curve *I*, curve *II* is the equivalent sinusoidal wave, and curve *III* is the current wave for open secondary; all of these curves are based upon the assumption that $x = 0$.

As will be seen, the secondary reaction causes a non-sinusoidal primary current to flow, and moreover it increases in the primary magnetizing current, in the present case about 5 per cent.

Curve *IV* shows the current in one of the secondary circuits. As will be seen, the amplitude of this current is very large, and may cause copper losses of some practical importance.

The assumption that x is equal to zero means that the current points, 3 and 9 and 4 and 10, etc., happen to coincide at the time point, $\alpha = 0$. It may happen, however, at any other time point just as well. Fig. 3 shows the curves *I*, *II* and *III* of Fig. 2 for $x = -30$. The wave shape of the current is now different from what it was before, for $x = 0$, but the current amplitude for the closed secondary condition is again about 5 per cent larger than that for open secondary.

Since in practice a light-running induction motor always has some slip, the value of x changes slowly and therefore the wave shape of the no-load current will also change constantly.

It is obvious that it is possible to carry through the previous considerations for other motors in a similar way, although matters become very complicated for motors as built in actual practice. It is, therefore, quite difficult to give quantitative data about phenomena hereinbefore discussed for practical cases. The previous study will, however, be sufficient to explain theoretically a series of phenomena being observed in practice.

Diagram of Electric Wave Lengths.

By W. W. Massie.

Wireless telegraph engineers and operators are frequently confronted by the problem of determining electric wave lengths with certain known capacity and inductance in circuit or of ascertaining the capacity and inductance required to produce a certain wave length. To eliminate the necessity of repeated calculations, the accompanying diagram, shown in Fig. 1, has been made.

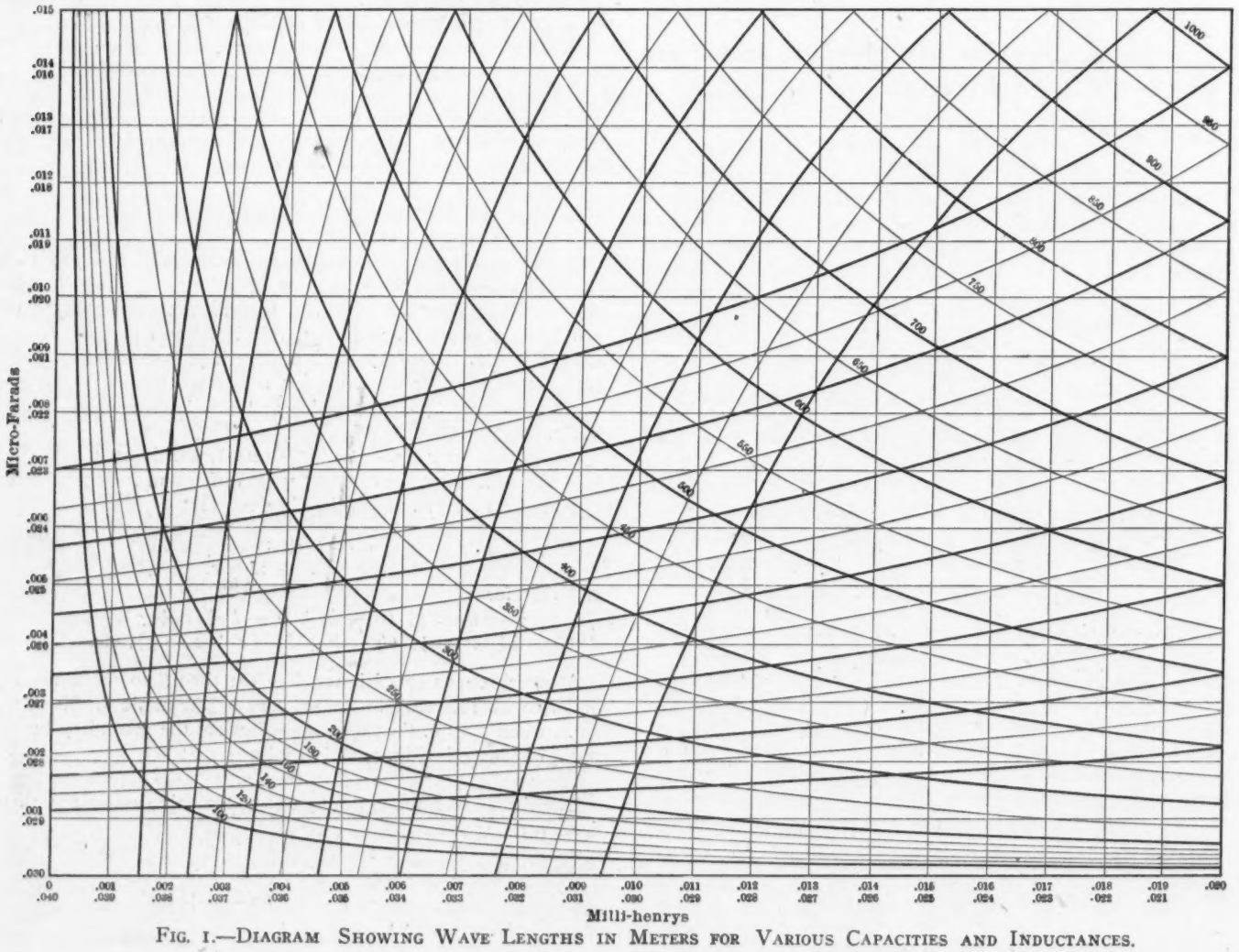


FIG. 1.—DIAGRAM SHOWING WAVE LENGTHS IN METERS FOR VARIOUS CAPACITIES AND INDUCTANCES.

The curves of the diagram are based on the following well-known formula:

$$C = \frac{\lambda^2}{4\pi^2 V^2 L}.$$

where

C = capacity,
λ = wave length,
L = inductance,
V = velocity of light = 300,574 km. per second,

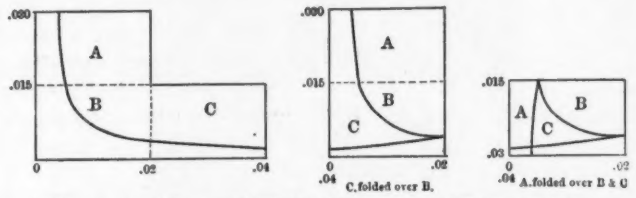
which can be written:

$$\lambda^2 = 4\pi^2 V^2 L C,$$

or

$$\lambda^2 = K L C,$$

in which K is a constant having the value indicated. From the last formula it is seen that a curve plotted to rectangular co-



FIGS. 2, 3 AND 4.—METHOD USED IN PLOTTING CURVES.

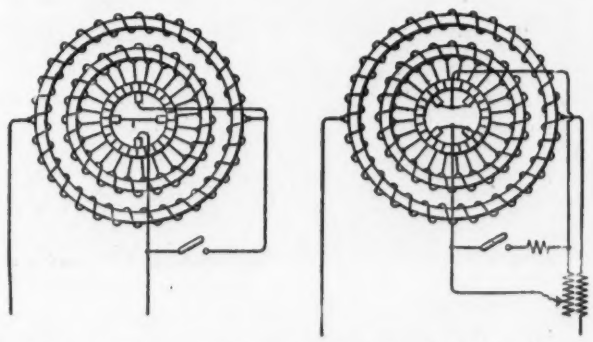
ordinates showing the relation between L and C for a constant value of λ will be an equilateral hyperbola.

To obtain accurate readings, and at the same time to minimize the size of the paper, the curves were plotted as illustrated in Figs. 2, 3 and 4. Fig. 2 shows the curve in its natural form. Fig. 3 shows the curve with section "C" folded over "B." Fig. 4 indicates both "A" and "C" folded over "B." At first sight the curves, laid out in this way, appear somewhat complicated, but with a little practice values can be easily and accurately read to five significant figures.

Since, for example, a wave length of 500 meters requires .010 m.h. with .007 m.f., or .100 m.h. with .0007 m.f., or .001 m.h. with .07 m.f., while a 5,000-meter wave requires .10 m.h. with .07 m.f., or 1.0 m.h. with .007 m.f., or .01 m.h. with .7 m.f., it can readily be seen that the range and values are not confined to these given in the diagram, but can be varied to an unlimited extent, as the value of C or L can be increased or decreased any number of decimal places if in doing so the opposite factor is decreased or increased a corresponding number of decimal places. The wave length can also be varied any number of decimal points if the decimal point in C or L is correspondingly changed two places for each one in the wave length, as shown by the formula above.

Self-Starting Single-Phase Induction Motor.

A patent issued July 31 to Mr. Maurice Milch describes means for giving an adequate starting torque to a single-phase induc-



FIGS. 1 AND 2.—CONVERTIBLE SERIES-REPULSION MOTOR.

tion motor. The machine is wound similiarly to a series motor, but is provided with an extra set of brushes short circuited upon themselves in line with the polarization of the field winding; the current in the latter set of brushes serves to neutralize the reactance of the field winding, and to give torque to the rotor by its product with the flux due to the current flowing through the other set of brushes on the commutator. When the motor is up to speed the armature is short circuited on two lines displaced from each other, and it acts as the rotor of a single-phase induction motor, operating substantially at synchronism under all loads. The motor may be arranged for operation directly at low voltage, as shown in Fig. 1, or the armature winding may be connected in series with the field winding through a transformer for operation at high voltage, as indicated in Fig. 2.

The Charlestown Dry Dock Motor Pumping Plant.

BY GRAHAM SMITH.

The opening of the new Charlestown dry dock has made the Boston Navy Yard a repair port for battleships and cruisers of

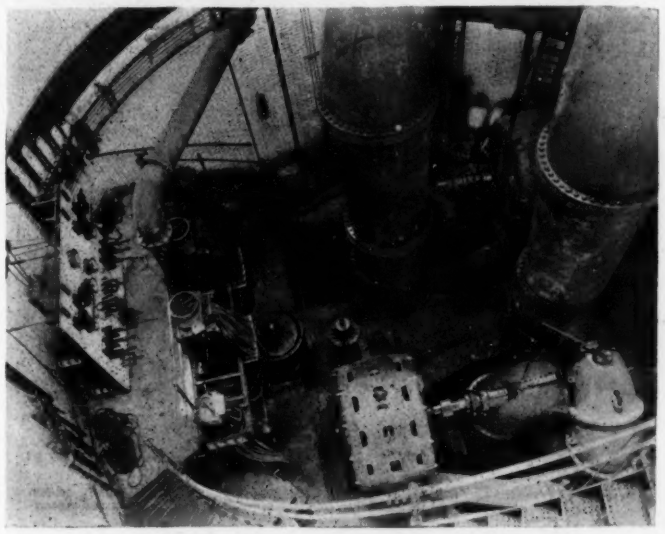


FIG. 1.—VIEW OF PUMPING WELL.

the first class, one step in an elaborate plan of improvements which contemplates the development of a naval port at Boston equal in importance to any in the country. The electrically-

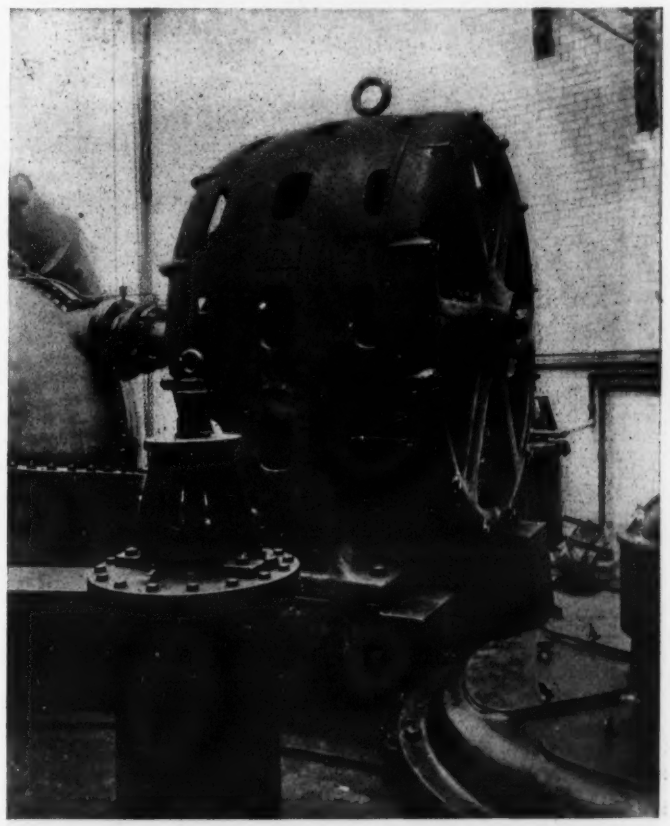


FIG. 2.—ONE OF THE 500-HP PUMP MOTORS.

driven pumping plant by which the new dock is operated and emptied is interesting not only as a highly successful application

of large induction motors, but as one of the most compact assemblages of power machinery and auxiliary apparatus to be found in any pumping installation in the world.

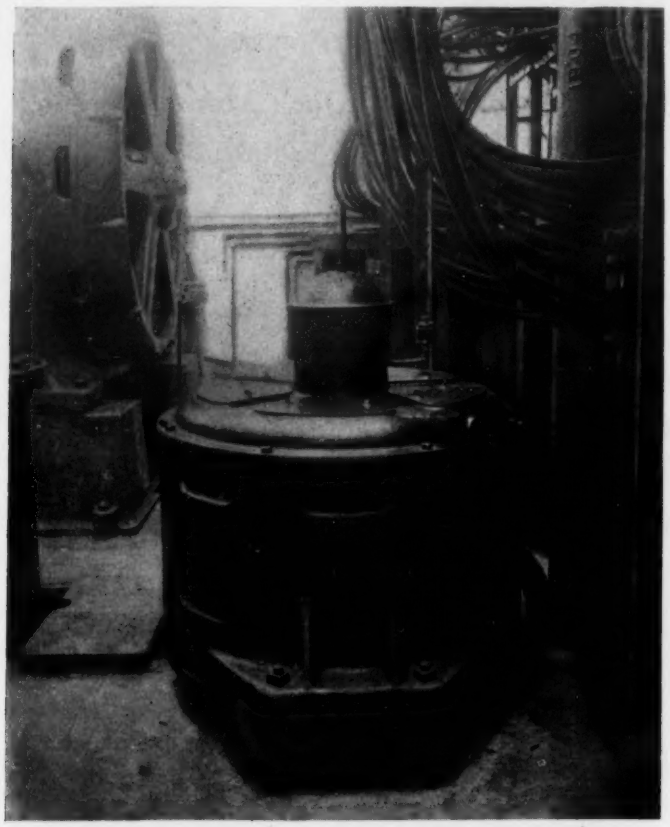


FIG. 3.—ONE OF THE 75-HP DRAINAGE PUMP MOTORS.

The old dry dock at Charlestown, which accommodates only vessels of inferior size, was emptied, prior to the completion of

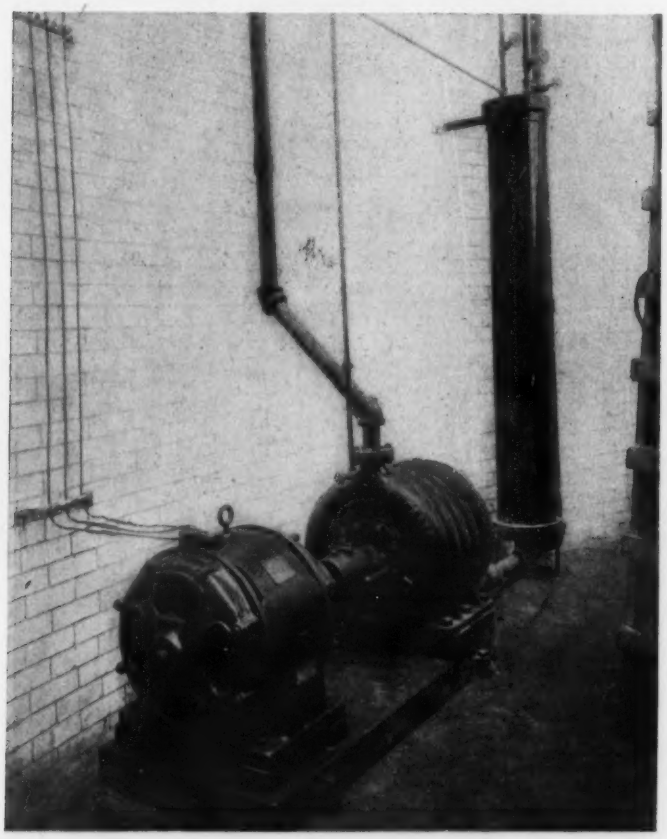


FIG. 4.—20-HP MOTOR CONNECTED TO CENTRIFUGAL PUMP.

the new dock and its motor pump equipment, by a steam-driven pumping plant. The new dock, about 750 ft. long over all, with a 678-ft. keel, and from 40 to 45 ft. deep, and the old dock, about half its size, are both emptied now by the motor plant, which is equipped for that purpose with two separate systems of valves and piping under the floor level of the well. The old dock was emptied by the steam-driven pumps in about 4½ hours. The new dock, of twice the capacity, was emptied by the motor pumps, in their initial test, to receive the battleship *Maryland*, in a little over three hours, with only one of the two main pumping units in operation.

The plans for the installation of a complete new power plant for the Boston Navy Yard, under the control of the Bureau of Yards and Docks, involve not only the supply of power for pumping the docks dry, but also the supply of electricity for lighting and power service throughout the buildings and grounds. The generating unit for the pumping work—a 750-kw Westinghouse turbo-generator set—was the first installation in the new power house. It delivers three-phase, 60-cycle current for transmission at 2,000 volts to the pumping well 1,800 ft. away, where it is reduced in Westinghouse oil-insulated, self-cooling transformers to 220 volts. The current from these transformers operates the pump well motors and three double and six single-drum capstans placed at equal intervals around the docks for handling ships and repair materials.

The operating machinery of the pump well consists of two 48-in. Morris centrifugal pumps driven by two 500-hp Westinghouse induction motors, operating the main pumping units, at 350 r.p.m.; two 12-in. Morris drainage pumps, set 15 ft. below the main pumps and driven by two Westinghouse vertical induction motors of 75 hp, 690 r.p.m., mounted at the top of long shafts, and a small five-stage centrifugal pump, for supplying hydraulic pressure for the operation of the main valves, driven by a 20-hp induction motor of 1,700 r.p.m. The motors are controlled from a switchboard mounted near them in the pit, the starting current being kept down by a graded resistance of many voltage steps.

The pumping well in which this machinery is installed is about 50 ft. deep, and only 45 ft. in diameter. The main pumping units are connected to the dock conduits by five 60-in. hydraulically-operated valves, and are equipped with two 54-in. hydraulically-operated discharge valves. The motors by which they are driven are capable of developing as high as 750 hp each, and the aggregate capacity of the pumping units is 135,000 gallons a minute.

Electric Cars of the Long Island Railroad.

The various features of the electrical equipment of the Long Island Railroad have been described from time to time in our

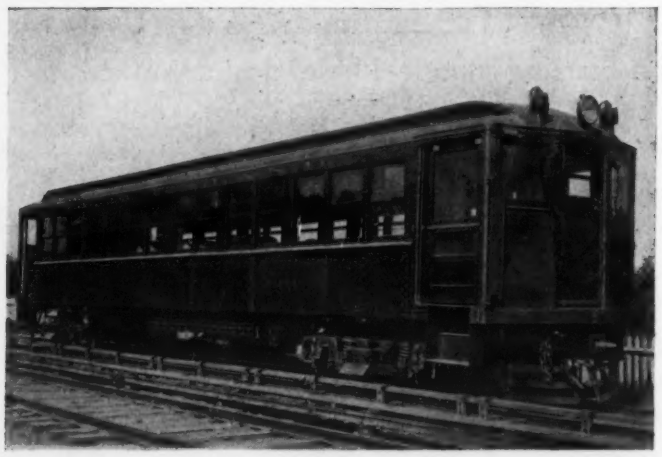


FIG. 1.—VIEW OF STEEL CAR.

columns, much information concerning the apparatus used in the generation, transmission and distribution systems being contained in articles which appeared January 7, 1905; November 4, 1905; June 9, 1906, and June 23, 1906. We now give below an outline description of the cars employed on this railroad.

As the Long Island Railroad cars were obliged to meet conditions similar to those encountered in the New York Subway, both as to the physical nature of the route to be traversed and the class of travel to be handled, they were built along practically the same lines as the steel cars for the New York underground system. In fact, except for the steps, which are made

necessary by the low platforms at stations in the suburban districts, the steel car bodies are practically identical with those designed for the New York Subway, by Mr. George Gibbs, who served as chief engineer of the Long Island Railroad electric conversion. The incidental advantages of these steel over wooden cars in superior strength and durability are, of course,

FIG. 2.—ADJUSTABLE CONTACT SHOE.

likewise of importance in insuring their adoption. By their use the public is insured against all danger from fire in cars equipped with apparatus carrying powerful electric currents.

The framework of the car is built up of angle irons properly formed and riveted, to which is riveted the side sheathing of the car which consists of steel plates ⅛ inch thick. A very light roof covering is used, consisting of composite board ⅜ inch thick, except over the vestibules, where it is of No. 16 gage steel sheet, the whole being covered with heavy canvas laid on with white lead. The flooring of the car body is laid on corrugated sheet iron, which is supported by the longitudinal sills and the steel-plate bridging that is riveted across the space between the sills. The corrugated sheets are provided with metal clips which are riveted to the sheets at about 10-in. centers, to secure the "Monolith" plastic floor upon which, after being finished, the maple floor strips are laid with brass screws. This monolithic floor is absolutely fireproof and is laid on in the form of a cement, which, when set, has a smooth, hard finish. The seat frames are of steel construction carried upon brackets riveted to the side posts. The cushion and seat backs are of rattan. The seating capacity of each car is 52 persons. The wainscoting is of steel, backed by asbestos "Ceilinite," so as to make it conduct heat less readily. There are 130 motor cars and four trailers, all of which were built at the Berwick, Pa., shops of the American Car & Foundry Company.

The motor and trailer trucks are of the M. C. B. type, the wheel base of the motor trucks being 6 ft. 8 ins. for 36-in. wheels, the trailer trucks being 5-ft. 6-in. wheel base for 30-in. wheels. The distance between truck centers is 34 ft. All of the trucks were manufactured by the Baldwin Locomotive Works.

The standard third-rail shoes on the motor cars are of the hinged-slipper type, supported on the usual wooden beam, which is clamped against the notched face of the equalizer spring seat castings, providing means for vertical adjustment. Upon the center of the beam is placed a 600-amp enclosed-type fuse in a wooden box, with a hinged cover and lined with asbestos.

Trains from the Brooklyn Rapid Transit Company's elevated lines operate over the Atlantic Avenue and Rockaway Beach Divisions by way of Chestnut Street Junction to Rockaway Park. The Brooklyn elevated lines have been for some years operated by the third rail, but the location of their rail is 22¼ ins. outside and 6 ins. above the track rail, while the Long Island Railroad third rail is 26 ins. out and 3½ ins. up. This made it necessary to devise some form of adjustable third-rail shoe which would operate with equal facility over both third rails and be able to change from one to the other at reduced speed without requiring attention on the part of the motorman or train crew. Such an arrangement has been worked out, and patents on it have been applied for by Mr. James C. Boyd. It consists essentially of a hinged slipper-type of shoe mounted upon a movable lug which is held in either position by means of coil springs and is actuated by an arm that engages with a stationary cam mounted alongside of the track, in line with the third rail. The movement of the car past this cam in one direction changes the shoe from the inner to the outer low position, while a reverse movement of the car past the cam changes it from the outer to the inner raised position.

The cars are equipped with hand brakes and with the Westinghouse quick-service automatic air brake. This brake differs from the standard apparatus in the passenger service in that it has (*a*) quick serial service application, (*b*) graduated release of cylinder pressure, (*c*) quick charging of auxiliary reservoirs, and (*d*) protection against over-pressure.

Careful investigation of the conditions of train weight and schedule speed that occur in the operation of the suburban lines of the Long Island Railroad showed that the greatest flexibility would result from a two-motor car equipment, using the most powerful motors practicable. The limitations were mainly the dimensions imposed by the largest trucks that could be operated under the conditions prescribed by tunnel and curve clearances, which restricted the wheel base of the motor truck to 6 ft. 8 in. This restricted the size of the motor to about 200 hp, and the study of the conditions was consequently reduced to an examination of the characteristics and gear ratio most suitable for this motor, and of its power of endurance to resist overheating. The general result of the computations was that a medium ratio (22 to 58 for the No. 113 Westinghouse motor), was fixed upon, the number of motor cars and trailers varying with the character of the service demanded.

The Westinghouse electro-pneumatic multiple control is employed, the unit switches being arranged in a row in a long box in such a manner that a hinged cover gives access to the main contact on one side and to the interlocking fingers on the other.

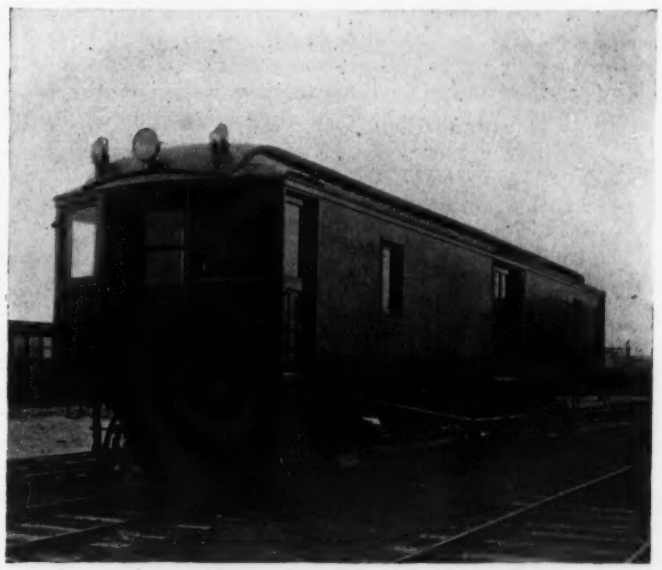


FIG. 3.—VIEW OF BAGGAGE CAR.

The master controller is fitted with a connection for operating an automatic brake cut-out. When closed in its normal position, this cut-out permits the handle of the master controller, when on the central notch, to complete a circuit which energizes the emergency train brake magnet valve, immediately releasing the air from the train pipe and setting the brakes. This arrangement makes effective the "dead mans handle" feature of this type of control. If the motorman removes his hand from the master controller handle from any cause whatever, it returns immediately to the central position and sets the brakes.

On the face of the master controller there are nine notches or stops, one in the center and four on either side, which engage the spring catch of the handle. The central portion, as stated,

causes an emergency application of the train brakes. The first notch is really the "off" or coasting position of the controller, and when the handle is at this point the train brakes are not applied, but all switches, including the line switch, are open. Reversal is accomplished by moving the handle to the opposite side of the center notch.

On the second notch or switching position, the controller establishes such connections with the train line that the reverse switch is thrown to the correct position, the line switch is closed, and the switch group closes the circuit of the motors with all the resistance in, thus effecting a slow movement of the train. This, of course, can only happen with all the train line jumpers connected up, so that the auxiliary control apparatus on each motor car is in parallel across the wires of the train line. The third notch is the series running position, and the fourth and last notch is the multiple position.

The interior of each car is lighted by twenty-six 16-cp incandescent lamps. Two 16-cp lamps are placed in each vestibule in such a manner as to effectively light the platform and the steps. One 16-cp lamp is located in each marker, and a 50-cp lamp is placed in the headlights, which are permanently fixed on the vestibule roof between the markers. The cars are heated throughout with electric heaters of the panel type, each having a ventilated sheet-iron back and being placed under the seats. The steel cars as thus constructed and equipped have now been in successful operation for over a year.

In addition to the steel cars above described, fifty-five wooden trailer cars, which had been built six or seven years previously with a view of using them in electrical trains, were equipped to run in trains with the motor cars. Five electric express cars were provided, equipped with the standard type of motor and trailer trucks, two 200-hp standard motors, and with the standard multiple-unit control apparatus. These cars are built of wood, 52 ft. 5 ins. over all in length, 9 ft. 9½ ins. in width, and with roof 12 ft. 6¾ ins. above the top of the rails. They are equipped with standard M. C. B. couplers, and haul the old standard steam baggage and express cars as trailers. The weight of these baggage cars is about 76,500 lbs. without load.

The equipment of the steel passenger cars, the auxiliary rolling stock, and the building of inspection sheds were carried out by Westinghouse, Church, Kerr & Co., who, as in the other portions of the complete equipment, acted as constructing engineers. The entire work of design and construction was in charge of Mr. George Gibbs, chief engineer of electric traction of the Long Island Railroad.

Dallas, Texas, Central Station Notes.

The Dallas Electric Light & Power Company is one of a number of properties in Texas controlled by Stone & Webster, of Boston. The same interests control the street railways in Dallas. The company has had difficulty in keeping up with the demand for electricity for some time past, but will soon be in a position to push for business as a new power plant is being erected with two 1,500-kw. Curtis 60-cycle turbo-alternators. Power plant construction is being carried out by the Columbia Improvement Company, which does all such work for the Stone & Webster properties. Mr. Charles H. Bigelow, formerly of the Boston Elevated Railway, is superintendent of construction at Dallas. The general management of Stone & Webster's Texas properties is under Mr. M. M. Phinney. Mr. Edward T. Moore is general superintendent of both electric light and street railway properties in Dallas, the superintendent of the electric lighting department being Mr. H. T. Winchester.

FANS AN IMPORTANT LOAD.

In all Texas cities the fan motor load during six months of the year is an important factor. There are many places where fans must be kept running constantly. Many of these fans are on flat rate contracts and are disconnected during the winter, others on meters. During the hot weather the fan motor load constantly grows until it reaches a maximum in September, after which it falls off slowly until December. August 1, 1905, there were 2,032 direct-current fans and 194 alternating-current fans connected. September 1, 1905, this had increased to 2,080 direct-current fans and 204 alternating-current fans. The rates for fans are as follows:

Flat Rates per Month—

Fans, ⅙-hp or less, from 8 a. m. to 7 p. m. or less.....	$1.50
Fans, ⅙-hp or less, from 8 a. m. to 1 a. m. or less.....	2.25
Fans, ⅛-hp or less, for 24 hours' service per day.....	3.00

Meter Rates—

From 1 to 1,000 kw-hours.....	5c. per kw-hour
Over 1,000 kw-hours.....	4c. per kw-hour

No discount is allowed on flat rates, but for meter rates the usual cash discount of 10 per cent on all bills paid on or before the 10th day after date of bill, is given.

It will be noticed that there are three classes of fan service: for 24, 17 and 11 hours per day. This makes it necessary to run two fan circuits which can be turned off at the power house or sub-station in order to prevent abuses of flat rate contract. This multiplicity of circuits is a peculiarity of central station practice in a number of Texas towns, which adds considerably to complications of overhead work and the cost of distribution. The flat rate system seems to have a very strong hold in Texas.

Direct-current power service is given at 500 and 250 volts three-wire, a sub-station for this service being maintained in the rear of the company's office building on one of the principal streets. The power load is 2,100 amp. during the day and falls to 275 amp. at midnight. Alternating currents are generated two-phase and distributed on single-phase lighting circuits. All the transformers in the down-town districts are 25 kw. The standard secondary mains are No. 2 wire. Secondary mains are all tied together solid in the downtown district without fuses between transformers. About two-thirds of the company's 6,600 customers are residence customers.

Electric light is naturally preferred to gas in most Texas towns on account of the warm climate and the heat from gas burners. For the same reason electric irons and cooking appliances should prove popular, although this business has not been developed to any great extent. The pushing of electric irons was begun in Dallas the first of the year. About 200 were in use by the middle of May, 85 of these having been sold during the previous month. A 6-lb. iron is sold for $5.

METER READING AND TESTING.

A very interesting system of meter testing has recently been put in practice. The customers are divided up among twenty-four meter readers' books. Three men spend one-half of their time reading and one-half setting, removing and testing meters. Some meter reading is done each day. Every day the three meter readers and testers divide up the contents of one meter route book among them and read all the meters listed in that book. In this way the reading of meters is carried on during twenty-four working days each month. The meter books are always read in the same order so as to bring customer's bills one month apart. The total number of meters used and in stock is about 6,900. The great advantage of this plan is that the book-keeping department instead of being rushed to death in making out bills at certain times in the month and having very little to do at other times, has a steady grist of bills to turn out every day. It is also more agreeable for the men to have a variety of work each day rather than to spend the time steadily reading meters, to the exclusion of everything else. Direct-current meters are tested every six months and alternating-current meters are tested once a year. After a customer's meter has been placed it is not brought back to the testing room for ordinary testing, such testing being done in place on the customer's premises. The only testing of meters done at the testing room is that of new meters received from the factory or meters removed from customer's premises. Two men are employed on outside testing and three men on reading, setting, removing and testing, as before mentioned. The Thomson high torque induction meter is the one principally used on alternating-current lines. Some of the outside testing is done with an indicating wattmeter and stop-watch. There has recently been purchased, however, for this outside work, a recording testmeter on which the revolutions are recorded on the dial. This has 1-amp., 10-amp. and 20-amp. coils.

Free lamp renewals are furnished on standard lamps only. Lamps are renewed if customer desires, before they are burned out. The meter rates for lighting are 10 cents per kw-hour for the first 300 kw-hours, with a sliding scale down to 7 cents per kw-hour for over 1,000 kw-hours. The rate for motors is 5 cents per kw-hour up to 1,000 kw-hours and 4 cents over that.

Rates for Lighting from a Trolley System.

Mr. L. R. Hicks, electrical engineer of the Aurora, Elgin & Chicago Railroad Company, sends us, with the forms of contract used, the following schedule of rates for electric lighting which have just gone into effect:

Business houses—12 c. per kw-hour for burning connected load 30 hours, per month, and all additional energy at 6 cents per kw-hour. The above rates are subject to a cash discount of 10 per cent for prompt payment in 12 days from date of bill. For all business houses who use more than 4,000 kw-hours per year, or an average of 400 kw-hours per month, will receive energy at 10 and 5c. For all those who use more than 9,000 kw-hours per year, or 750 kw-hours per month are to receive energy at an 8 and 4-cent rate.

Residence lighting—All sockets and outlets in living rooms are to be figured as having 16-cp, 50-watt lamps, installed. The term "living room" does not include porches, cellars, attics or closets. The maximum rate of 15 cents is figured on the basis of burning all the lights in the living rooms 20 hours each month.

The secondary rate is 8 cents. All the above rates are subject to a cash discount of 10 per cent for prompt payment at the company's office.

LETTERS TO THE EDITORS.

Unequal Tariff or No Bridge.

To the Editors of Electrical World:

SIRS:—Anyone who studies thoroughly the question of electric light rates has to investigate not only the charges for electric light, but the charges for other service, such as telephones, water, etc., etc.

You may be interested, therefore, in the charges made by a municipally owned bridge in one of the South America States, where the toll is 5c. for every person who wears shoes and 1c. for natives who do not wear shoes.

I believe they found that if they charged a uniform 1c. rate they would not get enough income to pay for maintenance; and likewise if they charged a uniform 5c. rate, the natives who did not wear shoes preferred to walk the ford, so that again they would not get enough income to pay for maintenance, and that the only way in which the bridge could be made self-supporting was to establish the above tariff.

BOSTON, MASS. R. S. HALE.

Sliding Scale Division with Employees.

To the Editors of Electrical World:

SIRS:—I was pleased to notice a short mention in the ELECTRICAL WORLD of a recent announcement to employees, as to their attitude toward the public.

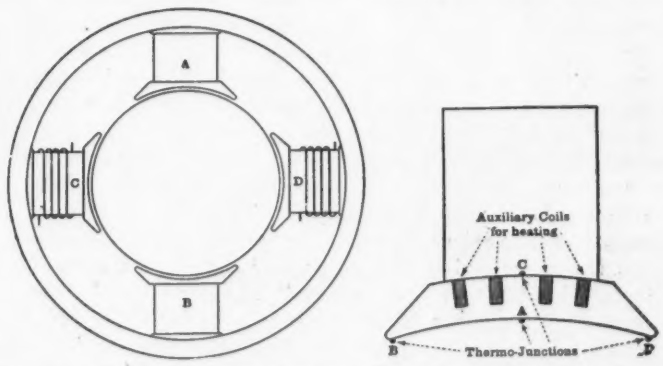
I thought you might be interested in our new plan of sliding scale division with the employees of the Boston Consolidated Gas Company. We have just arranged to set aside a fund to be drawn upon at the end of this year, to be known as the Employees' Fund. Out of this fund will be paid to each employee who has given efficient service and shown ability, and who has been in the employ of the company for at least a year, 7% of the amount of his annual salary. This applies right along the line to every employee, excepting the president and vice-president of the company. The details of the plan have not been fully arranged but the percentage thus paid is intended to be the same as the rate of dividends payable on the company's stock. For the coming year the amount is 7%. With every reduction in price that may be made the amount of dividends, as you know, will be increased. A corresponding increase will be made in the percentage payable on the employees' salaries. This, of course, will serve as an incentive for the employees to work toward a reduction in the price of gas. This reduction can only come through increased sales and through economies in operation, so that the plan should lead every employee to give his best efforts in these directions.

BOSTON, MASS. E. N. WEIGHINGTON, *Secretary.*

DIGEST OF CURRENT ELECTRICAL LITERATURE

Dynamos, Motors and Transformers.

Determining the Iron Losses in Pole Shoes, Due to Armature Teeth.—WALL AND SMITH.—It is well known that in continuous-current and in synchronous machines with slotted armatures, losses are produced in the pole-shoes by the eddy currents and the hysteresis effect, which owe their origin to the pulsation of the main flux, caused by the movement of the teeth across the pole face. These losses occur to some extent even when the pole-shoes are laminated. The method of the authors is based on the fact that all the power consumed by these losses is dissipated in the form of heat. In determining these losses the authors allow the machine to run first with flux passing through the experimental pole-shoe (with the heating due to iron losses) and then without flux passing through the experimental pole-shoe (and therefore with no iron losses in the pole-shoe)—but with all other conditions unchanged—whilst its temperature is maintained constant by means of an external source of power. The amount of power thus needed to produce a temperature equal to that attained by the heating due to the iron losses will be a direct measure of these losses. For artificial heating the authors use an electric method, special resistance coils being completely embedded within the pole-shoe, as shown in Fig. 2. In order to have the flux present in the experimental pole-shoe in one-half of the experiments and absent in the other half, and to obtain the same conditions of heating due to the field-exciting coils both when the flux is present and when it is not, the authors use a four-pole machine as indicated in Fig. 1. Only two of the poles, *C* and *D*, diametrically opposite to one another, are provided with exciting coils. When these poles are so excited that *C* is the north pole and *D* the south, then no flux whatever will pass through *A* or *B*. On the other hand. if *C* and *D* are both excited to give the same polarity, then both *A* and *B* will assume the opposite polarity. Thus by simply reversing the current in either *C* or *D*, it is possible to have flux or no flux in *A* and *B* at once; while at the same time the heating of the system due to



FIGS. 1 AND 2.—ARRANGEMENTS OF FIELD AND OF HEATING COILS.

the exciting current is precisely the same in the two cases. For artificial heating, four slots were cut in the pole-shoe which was to be experimented upon and resistance coils were wound as shown in Fig. 2, one coil being placed in two slots, the two coils being connected in series or parallel according to the amount of power it was found necessary to supply. To measure the temperature at different parts of the shoe thermo-couples were used, by simply soldering thin copper wires to the iron shoe, one iron wire soldered to the shoe serving as a common terminal for all the couples. The procedure of the experiments was as follows: The machine was run at a certain speed with a certain excita-

tion with the flux passing through the experimental pole-shoe, and producing heating thereby on account of its pulsations. After a steady state had been reached the temperatures were measured. Then the connections of *C* and *D* were reversed so that no flux passed through the experimental pole, and electrical energy was now supplied to the auxiliary heating coils. After a steady state had been reached the pressure and current were measured, and thus the first point of the curve was found. The pressure was then varied and another determination made and point 2 was found, etc. This yielded a curve from which the power corresponding to the mean value of the temperature distribution when iron losses were present could at once be found. In this way the authors determined how the iron losses in the pole-shoes vary with the flux density and with the speed.—Lond. *Elec.*, July 27.

Harmonics Produced by Armature Teeth.—Simons.—A translation in abstract with diagrams of his German paper recently noticed in the Digest on the origin and wave form of the harmonics produced by the armature teeth of the alternators.—Lond. *Elec.*, July 27.

Lamps and Lighting.

Flame Arc Lamps.—Blondel.—Impregnated carbons, as used in flame arc lamps, are usually placed side by side in an inclined but nearly vertical position. Bremer has given the following reasons for this arrangement. If the two carbons are placed, as usual, above one another, the positive one above and the negative below, the light is very unsteady due to the rising and whirling of the vapors of the chemicals with which the carbons are impregnated; moreover slags will form on the upper carbon and will drop down on the lower carbon and extinguish the arc. Bremer found further that with the two carbons placed one above the other the efficiency is always lower than with the carbons side by side. Blondel has studied the reasons of this phenomenon. The crater of the positive carbon emits only a small amount of light, most of the light coming from the arc between the carbon points. It is, therefore, advantageous to lengthen the arc. The arc, however, consists of a mixture of very different gases: carbon vapors which are heavy and good conductors, but do not emit much light, and the vapors of the mineral salts which emit much light; the latter vapors are first carried down more or less, but then leave the path of the arc and rise upwards in the form of whirling vapor, surrounding the upper carbon with a flame. If the old arrangement is used, in which the upper carbon is positive, the incandescent vapors, when rising, will cool off, since they are no longer subjected to the action of the electric arc; they will thereby cease to emit light and will become non-transparent. The increase of candle power is, therefore, relatively very small with increasing length of the arc. The whirling of the rising vapors causes unsteadiness of the light, especially when the voltage is above 30. This voltage, however, is not sufficient for the production of a good illumination, but it is necessary to raise it to 50 volts or more. The mineral salts with which the upper carbon is impregnated are brought to white heat to a certain distance. They thereby exude from the carbon and form slags which drop from the terminal point of the positive carbon down upon the negative carbon. To avoid these serious disadvantages, Blondel places the positive carbon, which is impregnated with mineral salts, at the bottom, while the upper carbon is positive and is of pure or only slightly impregnated carbon. The result is that any slags exuding from the positive carbon can no longer do any harm. At the same time, a greater length of the arc now becomes incandescent, since the rising metal vapors now follow the same path as the carbon particles attracted by the upper negative carbon and, therefore, remain subject to the action of the electric current which renders them incandescent. By this means alone, however, no steadiness of the arc could be obtained, since the point of contact between the arc and the upper carbon would dance around the upper carbon. This disadvantage, however, may be avoided, if the upper carbon, near its end, is surrounded by a refractory disc which acts as a "support" for the arc and prevents it from rising further up along the carbon. Moreover, the terminal point of the upper carbon and the metal vapors surrounding it are thereby heated to such a high temperature that the vapors cannot liquefy to drops. The refractory disc also acts as a reflector so that all light is sent downwards and rendered useful. In this way one gets an increase of from 10 to 40 per cent in candlepower and an arc of great length and high temperature, and of voltages of 50 or more can be used.—*Zeit. f. Beleucht.*, July 30.

Osram Lamp.—A note stating that nothing definite has yet been published concerning the nature of the new "osram" lamp of the Welsbach Company, but that the new lamp will be put on the market in the coming season. The new Osram lamp is said to consume 70 per cent less power than an ordinary carbon incandescent lamp, while the osmium lamp represented a saving of only 56 per cent. A great advantage over the osmium lamp (which can be built in general only for low voltages) is that the osram lamp can be made for the usual voltages of 100 or 110.—*Zeit. F. Beleucht.*, July 30.

Power.

Blast Furnace Gas Engines.—Hubert and Westgarth.—At the recent meeting of the Iron and Steel Institute in London three papers were presented dealing with the use of large gas engines worked by blast furnace gases. The papers of Hubert and Westgarth are reproduced in the present issue, while the paper by Reinhardt on German practice is promised for a later issue. Hubert discusses the design of blast furnace gas engines in Belgium, and gives a detail account of the work of the Crockerill Company. In a test recently made by him and Witz of a 1,400-hp, two-cylinder, double-acting and tandem engine, the following results were obtained:

	½ load.	¾ load.	Full load.	Overload.
Electric hp	917.5	1250.7	1404.7	1487.7
Consumption in cubic meters per el. hp-hr. at 0.02760 mm.	3.425	2.707	2.657	2.542
Calories used per el. hp-hour	3353.1	2606.8	2505.6	2511.5
Thermal efficiency in per cent	29.82	28.52	28.98	29.84

The paper of Westgarth gives a classification of the number and sizes of gas engines above 500 hp built in Great Britain for operation either with producer gas or blast furnace gas. Such gas engines have been made by six different companies in England.—Lond. *Elec.*, July 27; abstracts of these papers are also found in *Iron Age*, Aug. 9; a discussion of developments in this country in *Electrochem. & Met. Ind.*, August.

Power Plant of Mine.—Rosterg.—A detailed illustrated description of the power plant of the Wintershall mine in Heringen on the Werra. There are two hydro-electric stations which are described in detail; one contains two turbines each of 245 hp, the other two turbines each of 197 hp. They are connected to three-phase generators, the generating and transmission voltage being 5,500. At the mine the voltage is reduced to 525 for power purposes and this voltage is again reduced to 115 for lighting. For the main winding machine the Ilgner system is used. The installation is described in detail.—*Glückauf.*, July 28.

Australian Water Power Plant.—Martinek and Lauri.—An illustrated article on the hydro-electric station of the City of Launceston on the Island of Tasmania. A hydro-electric plant was erected in 1896, using five turbines each of 160 hp and generating single-phase current at 2,000 volts. This plant has become too small and it was therefore decided to build a new plant containing five turbines each of 500 hp, and changing from single-phase to three-phase current, and raise the e.m.f. from 2,000 to 5,000 volts. The new plant is described in detail.—*Elek. Zeit.*, July 19.

Turbo-Alternators.—Legros.—An account of tests of some recent turbo alternators made by the Oerlikon Company, paying special attention to progress made in the design and giving a description of the method of tests, especially applicable to turbine alternators.—*L'Eclairage Elec.*, July 28.

Dredges.—Cory.—A fully illustrated article on the construction and operation of gold-dredging machinery, with special reference to electric driving.—*Jour. of Elec., Power & Gas.*, July 21.

Traction.

Three-Phase Railway.—An illustrated description of the Brunnen-Morschach electric rack railway in Switzerland. The length of the line is about 12¾ miles, the mean gradient being 12.6 per cent and the maximum gradient 17 per cent. Three-phase currents are transmitted at 8,000 volts, 50 cycles, and are stepped down in a transformer station to 750 volts. Each locomotive weighs 10½ tons complete, and is stated to be able to exert a

pull of 15,500 kg (34,300 lbs.) on the maximum gradient (17 per cent) at a speed of 9 km (5.6 miles) per hour. Two independent hand brakes are provided. In common with most rack locomotives, the motors drive through a clutch which is capable of a certain amount of slip. Each locomotive is fitted with two three-phase induction motors, the pinions of which drive on the same gear wheel. Current is taken from two overhead collectors to a double switch which serves at the same time as main switch and reversing switch. The third phase is connected with the track rails which are bonded, and this phase is taken direct through the frame to the motors, one terminal of each of which is connected to the casing. In order to produce an electrical braking effect when traveling down hill by using the motors as generators, the rotor of each motor is provided, in addition to its ordinary three-phase winding, with a continuous-current winding and a commutator, the brushes of which are connected to two phases of the stator winding, thereby forming a short-circuited series generator working with a very strong field. As the three-phase winding is also moving in this field a three-phase current is generated in it, which flows directly into resistances where its power is dissipated. In this way a powerful braking effect is produced without in any way relying on the current supply.—Lond. *Elec.*, July 27.

Third-Rail Road.—An illustrated article on operating details of the Lackawanna & Wyoming Valley Railroad, from Scranton to Wilkesbarre, Pa. The line operates freight as well as passenger trains. The company was one of the first to use a side third-rail and has made little change in the character of the rail or insulation. For cleaning ice off the third rail the company uses brushes with a weak solution of calcium chloride.—*Str. R'y Jour.*, August 4.

Petrol-Electric Motor Car.—A note stating that experiments have been made on the Hungarian Street Railways with a single petrol-driven railway car with electric transmission, and these have been so satisfactory that the Hungarian Government have placed orders for 150 cars working on this system. The experimental car had a temporary equipment of two 20-kw generators, each direct-driven by a four-cylinder vertical De Dion petrol engine, but a single 50-kw set will be employed in the other cars. Two motors are used geared to different axles, and series-parallel control is employed. Extensive trials were made at Arad, and with a car weighing 18.2 tons, running at 38.5 miles per hour, 36.3 kw were required. With the price of petrol prevailing in Hungary, the cost of fuel per kilometre worked out at 5 centimes. The experimental car has been put into service while the others are being got ready.—Lond. *Elec.*, July 27.

Electrolysis from Stray Currents of Tramways.—CONGDEN.—A paper read before the Ohio Gas Light Association on the protection of service pipes. The first part deals with a general discussion of the corrosion of pipes, while the second part deals with the effects of electrolysis from the stray currents from rails used as return in tramway systems. The author thinks that such electrolytic action will continue unless it is possible to find a surface coating which is either a non-conductor or waterproof and chemically inert. (In the discussion which followed Shattuck said that he had tried coating mains with cement and had fouud that this cement could be made to adhere to the pipe thoroughly, it seemed to be a pretty good protector; but, in long stretches there are sure to be places where the moisture will gather between the pipe and the cement; the cement will flake off and allow the electrolytic action to take place. He laid 1,000 ft. of 4-in. main in front of the power house in a trough and practically buried the pipe in cement 2 in. thick. Electrolytic action was found to be prevented, but it simply forced the current to come off the pipe farther back. Gardiner stated that where pipes had been coated with cement and a steel wire wound about them spirally imbedded in the cement, a concrete-steel construction was formed which prevented its breaking away.) Another method is to survey the district frequently, and wherever the potential of the gas main is found to be higher than that of the track, neighboring pipes and structures, a connection is made with the main and a conductor connected from the main to the negative bus bar of the nearest sub-station.—*Prog. Age*, June 1.

Electrophysics and Magnetism.

Imperfect Dielectrics and Resonance.—BENISCHKE.—According to the theory, an alternating-current circuit having the resistance r, the inductance L and the capacity C in series and frequency n, shows the phenomenon of resonance, if the magnetic reactance $2\pi n L$ equals the capacity reactance $\frac{1}{2\pi n C}$. In this case the current is $E \div r$, where E is the voltage impressed on the terminals of the circuit. If this experiment is made, it will be found, however, that the maximum value of the current is in most cases considerably below the theoretical value. The reason is that commercial condensers are imperfect. A perfect condenser permits only wattless currents to pass and does not consume any power. Commercial condensers, however, consume power chiefly for three reasons; first, the insulating material used in the dielectrics has no infinitely high specific resistance and there is, therefore, a development of Joulean heat; second, almost all insulating materials show the phenomenon of so-called "dielectric hystersis" (which is, however, a wrong expression according to the author, since it is not strictly analogous to magnetic hysteresis); the condenser plates are in general not so firmly fixed that there would not be attraction and repulsion due to the increase and decrease of the charge, in which case the condenser "sings," performing mechanical work. Even such condensers in which an almost ideal insulating material is used, like air, pure oil, pure paraffine, pure colorless mica, etc., show losses, due to shunt currents passing over. With gaseous and liquid insulating materials, the increase of the condenser voltage over certain values results in silent discharges, brush discharges, spark discharges, etc. With solid insulators discharges pass over the rims. The ordinary theory assumes only an inductance and a capacity in series, but on account of the imperfection of commercial condensers the losses in the condenser must be considered and this may be done mathematically by assuming a non-inductive resistance in parallel with the condenser. The author gives the condition of resonance for such a circuit and adds two numerical examples. He shows that the imperfection of the condenser results in a reduction of the maximum value of the current, resonance occurring now at a lower value of the self-inductance. The reduction of the maximum value of the current is the greater the smaller the condenser resistance, the frequency and the capacity.—*Elek. Zeit.*, July 26.

Coherer Action.—WEISS.—A critical note on the theory of coherer action with special reference to the work of Schneider and Blanc. Schneider's work brings out an analogy between coherer action and the electric arc; the action being something like electric welding. Blanc proposes, on the other hand, an ionic theory of coherer action. The present author believes that the latter theory is right in so far as incident waves have the effect of facilitating the diffusion of ions across the surface layers of the metals, just as ultra-violet light liberates electrons from negatively charged bodies. On the other hand, he inclines to the view that both of these actions, welding and diffusion, are at work in the coherer. That welding is effective is shown by the practical experience that elements or terminals with sharp edges are more effective than those with blunt or polished ends.—Lond. *Elec.*, July 27; from *Jour. de Physique*, Volume 5, page 462, 1906.

Internal Friction of Gases.—PEDERSON.—An investigation of the influence of molecular constitution upon the internal friction of gases. After an extended discussion of former investigations of the subject, the author gives an account of his own investigation, in which he developed a new and simple apparatus for determining the internal friction of gases and vapors. The coefficients of internal friction of eight ether gases were determined, and the molecular volumes calculated from the friction were found to agree fairly well with those obtained by Kopp's rule. A marked and unmistakable difference between the normal propyl and isopropyl ethers was found, proving that a difference in the molecular structure of these ethers has a marked effect upon their internal friction, and therefore upon the size of their molecules, the molecules having the most numerous branches, being smaller than those with fewer or no branches.—*Thesis*, New York University.

Electrochemistry and Batteries.

Gold and Silver Refining.—TUTTLE.—An account of the elec-

trolytic refining practice in the Philadelphia Mint. The bullion to be parted and refined is divided into two classes, by selection and by blending in making up the materials for anodes. One class is very rich in gold selected for electrolytic treatment in a gold chloride solution containing free acid, according to the Wohlwill process. The other class has silver as the predominant metal, but carries as much gold as will permit its treatment by electrolysis in a silver bath. In this class a 3 per cent solution of silver nitrate with 1½ per cent of nitric acid is used, with a very small amount of gelatine, whereby the deposit is obtained in a coherent form, so as to allow the vertical system of anodes and cathodes to be employed.—*Electrochem & Met. Ind.*, August.

Manufacture of Storage Battery Grids.—Herkenrath.—A note on casting storage battery grids and on the preheating of the casting moulds.—*Centralbl. f. Accum.*, June 5.

Units, Measurements and Instruments.

Electrostatic Voltmeters.—Benischke.—With reference to a recent paper of Fischer, the author discusses the influence of frequency and wave form on electrostatic voltmeters. The reason for the discrepancy with the theory found in various types of electrostatic voltmeters is due partly to the properties of the insulating materials used and partly to the torque due to electricity escaping from the rims of the revolving wings which act like sharp points.—*Phys. Zeit.*, August 1.

Alternating-Current Instruments.—A summary of several recent papers by Sumpner on moving-coil alternating-current instruments which have already been noticed in the Digest; with a brief reply to some recent criticisms of Stevens.—Lond. *Elec. Rev.*, July 27.

Meter.—In accordance with the German laws, the Reichsalstalt announces that it has admitted for calibration the alternating-current induction meter of the Danubia Company, and gives a detailed illustrated description of its construction with rules as to its calibration. The meter is a single-phase alternating-current induction meter for currents from 2 to 250 amperes and for voltages up to 250.—*Elek. Zeit.*, July 19.

Cable Testing.—Winkfield.—An illustrated description of a modification of the cable zero conductor resistance test for submarine cables which has been used for two years on all the Pacific Cable Board's cables and has proven quite satisfactory even in the hands of untrained observers.—Lond. *Elec. Rev.*, July 27.

Magnetic Testing of the Soundness of Iron Castings.—Kann.—In order to test the homogeneity of iron or steel plates and to detect any pipes or blow holes, the author recommends the passing of a plate before a U-shaped electromagnet, provided with a secondary coil connected to a galvanometer. If the plate is sound throughout there will be no change in the path of the magnetic lines of force passing through the plate, but such a change will at once take place when a blow hole or pipe is in front of the magnet. In this case the galvanometer will at once give an indication.—*Phys. Zeit.*, August 1.

Telegraphy, Telephony and Signals.

Cable Station.—Tabler.—An illustrated description of the station of the Eastern Telegraph Company in Alexandria, Egypt, which is an important center of submarine cables. This station is especially interesting since it is provided with the most modern apparatus of submarine telegraphy. In the present installment the testing room is described.—*Jour. Telegraphique.*, July 25.

Interference in Wireless Telegraphy.—Fessenden.—The conclusion of his paper on interference in wireless telegraphy and the International Telegraph Conference. The author believes that the government should insist on the international adoption of two different wave lengths, one of 500 meters for mercantile use, and the other of 550 meters for navy and army work. Stations operated by companies or individuals should not be allowed to operate within 5 per cent on either side of these two wave lengths.—Lond. *Elec. Rev.*, July 27.

Miscellaneous.

Exposition.—A preliminary report on the Bavarian Jubilee Exposition in Nuremburg, which was opened in May. It covers an area of 500,000 square meters and electricity is used throughout for lighting. For out-door lighting 500 arc lamps are installed, while in the interiors of the buildings there are provided 300 arc lamps and 3,200 incandescent lamps. For the effective lighting of the facades of all buildings 20,200 incandescent lamps are used while 42 arc lamps, each of 60 amperes, are employed for the search light of the illuminated fountain and two arc lamps of 90 and 250, respectively, for the search lights of the two observation towers. The main machine hall contains exhibits of 109 Bavarian firms. Steam engines, steam turbines, gas engines, Diesel engines, and Haselwander engines are used as prime movers, while electricity is generated by 17 dynamos with an aggregate capacity of 3,500 kw. Numerous motors are employed for driving pumps and all kinds of machinery in the exhibition. There is also a wireless telegraph station using the Braun system.—*Elek. Zeit.*, July 12.

German Association of Electrical Engineers.—A summary of the regulations and rules which were adopted at the last convention of the German Assoc. of Elec. Eng. in Stuttgart. They relate to the conditions of connecting motors to public supply networks, to the protection of electric plants against excessive voltages and to various details of wiring. The more important of these regulations were abstracted in the Digest when they were first proposed.—*Elek. Zeit.*, July 12.

Magnesia.—Goodwin and Mailey.—An experimental study of the physical properties of fused magnesium oxide. The melting point is between 1,890 and 1,940° C. The electric conductivity of magnesium oxide is less than that of porcelain up to about 1,100° C, but at higher temperatures magnesium oxide becomes a better conductor. There is a close agreement between the value of the expansion coefficient of fused magnesia and that of platinum.—*Phys. Rev.*, July.

Electric Blasting.—Maurice.—The conclusion of his long illustrated serial on electric blasting apparatus, with special reference to its use in coal mines. The author discusses briefly the dangers of electric blasting and the precautions which should be taken.—Lond. *Elec.*, July 20.

Colloids.—A summary of the properties of colloids and their utilization, for instance in dyeing and tanning, in the preparation of the metallic filaments of the new Kuzel lamp and as an analytic agent for certain organic reactions.—Lond. *Engineering*, July 6.

Experiences on the Road.—A note by Sweeney on unloading a large rotor, also notes by McConnon on troubles due to too low speed of the exciter, to the interchanging of two field coils, to wrong adjustment of the series shunt and to moisture getting into high-tension transformers.—*Elec. Jour.*, July.

Engineering Concern.—Kerr.—An article giving the history and the purpose of the concern of Westinghouse, Church, Kerr & Co.—*Elec. Jour.*, July.

BOOK REVIEWS.

Elettrotecnica. By Guido Grassi. Vol. II. Turin: Roux & Viarengo. 540 pages, 319 illustrations. Price, 16 lire.

This volume is divided into eight parts, the first three dealing with the design and operation of direct-current motors, alternating-current motors and rotary converters. Part IV gives a brief review of the theory and application of storage batteries. Part V deals with the problems of excitation, parallel operation, etc., of different types of direct-current generators and alternators. Part VI describes the different systems of distribution and the calculation of the distributing lines for different systems. In Part VII are described the central stations and the distributing lines, with numerous examples and data on apparatus for modern installations. In the final part the author deals with the subjects of incandescent lamps, arc lamps and electric traction.

The exposition and mathematical treatment are concise and clear, with abundant graphical and physical interpretations of the formulas, and numerous descriptions of standard apparatus of best European and American makes. The book is entirely modern, so that, independent of its high technical value, it has the additional advantage of giving a comprehensive and critical review of the up-to-date status of development of the electrical art in the branches covered by the work.

THEORIE UND BERECHNUNG ELEKTRISCHER LEITUNGEN. (Theory and Computation of Electric Main Conductors). By Gallusser and Hausmann. Berlin: Julius Springer. 162 pages, 145 illustrations. Price, 5 marks.

This volume is a condensed text-book upon the theory and engineering computation of mains for the distribution of light and power on the direct, single-phase or three-phase systems, two-wire, three-wire or four-wire. It is very practical and is abundantly illustrated.

The work is divided into twelve chapters as follow:—Single-phase networks, three-wire systems, polyphase systems, feeders, design of conductors for temperature, design of conductors for fall of potential, equalizing mains, design of conductors for economy of cost, relations between economy and voltage, choice of systems, regulation. The treatment is clear and direct, and the work is written for engineers. It applies to engineering work in any country. The book will be useful to technically trained students interested in electrical power distribution.

BOOKS ON ELECTRICITY. An Annotated List. Brooklyn: Pratt Institute Free Library. 33 pages.

This annotated list of electrical books in the library of Pratt Institute, Brooklyn, is admirably adapted for its purpose—the guidance of students and others in the selection of books on either general or special electrical subjects. Each title is followed by a brief note to give a clue to the contents of a book and the method of treatment. The work of annotating is in general well done, if we except an apparent leaning toward non-authoritative and easily read works of the kind written for the "book market" rather than designed as serious contributions to electrical literature. As an electrical library for students, the collection is, however, to a great extent out of date, and sadly needs rejuvenation.

BOOKS RECEIVED.

THE PRACTICAL TELELPHONE HANDBOOK. By J. Poole. London: Whittaker & Company. Third Edition. 533 pages. 473 illustrations.

INDUSTRIAL FURNACES AND METHODS OF CONTROL. By Emilia Damour. New York: The Engineering & Mining Journal. 305 pages, 38 illustrations. Price, $4.00.

PRACTICAL LAWS AND DATA ON THE CONDENSATION OF STEAM IN COVERED AND BARE PIPES. By Charles P. Paulding. New York: D. Van Nostrand Company. 102 pages. Illustrations. Price, $2.00 net.

BRIQUETTE AND PATENT FUEL. By Philip B. Bjorling. London: Rebman. 254 pages, 121 illustrations. Prices, $3.75.

New Telephone Factory in Chicago.

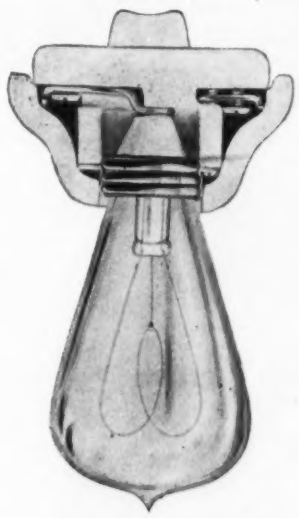
The growth of the business of the Automatic Electric Company since its incorporation in 1901 has been little short of phenomenal. The Automatic Electric Company has now been obliged for the third time since its incorporation to enlarge its plant to enable it to meet the increasing demand for automatic equipment, and is erecting, on the property adjoining its present plant, southwest corner Van Buren and Morgan Streets, Chicago, a duplicate of the building now in use, to be joined to it by a smaller structure, the administration building, in which will be housed the company's offices.

The new buildings, which will be completed and occupied by December of this year, will be of mill construction, brick, with a cream brick facing exactly similar to the present structure. The factory addition will be 85 feet front on Van Buren Street, and 165 feet deep. It will be six stories high. The administration building will be 40 feet front and 40 feet deep, the same height as the factory buildings, but the first story will be omitted and the space underneath the second floor used for a driveway to the large court between the two factory buildings. This court will be 40 feet wide by 123 feet deep. Fire walls will separate the administration building from the factory buildings.

The entire frontage of the plant on Van Buren Street will be 210 feet. The monotony of such an extensive frontage will be broken by recessing the administration building two feet from the line of the factory structures. While the actual floor space of the plant will be a little more than doubled, by reason of a most economical arrangement of space, machinery and the routing of the product from start to finish of manufacture, the capacity of the plant will be trebled. The enlarged plant will be supplied with all that is most modern and most efficient in machinery and appliances for rapidity of manufacture, and the comfort and convenience of operatives. The various manufacturing departments will be so arranged that the raw material will enter at one part of the plant and will take a direct route through, coming out as finished material at another point. The completed plant will be one of the finest and best arranged factories in Chicago. The architect is W. Carbys Zimmerman; the contractor is the Wells Brothers Company.

Incandescent Lamp for Weatherproof Circuits.

The Rooney Electric Lamp Company, of 155 East 23rd Street, New York, has brought out an incandescent lamp fitted with an improved base, which makes the lamp especially serviceable for use in signs, exterior decorations or places subject to weather conditions and dampness. Attention is directed to the increased insulation distance between the metal parts of the base. Buttons of glazed porcelain of extra depth are used since these do not absorb moisture and consequently diminish the chances of electrolytic action or short circuit. Those having experience with lamps used in outdoor work are aware of the fact that in many cases water leaks into the lamp socket and eventually short-circuits the lamp. Moreover, decorative lamps are often subjected to severe conditions of service other than weather conditions. At Luna Park, Coney Island, for instance, it is the daily practice to wash the board walks around the lagoons with salt

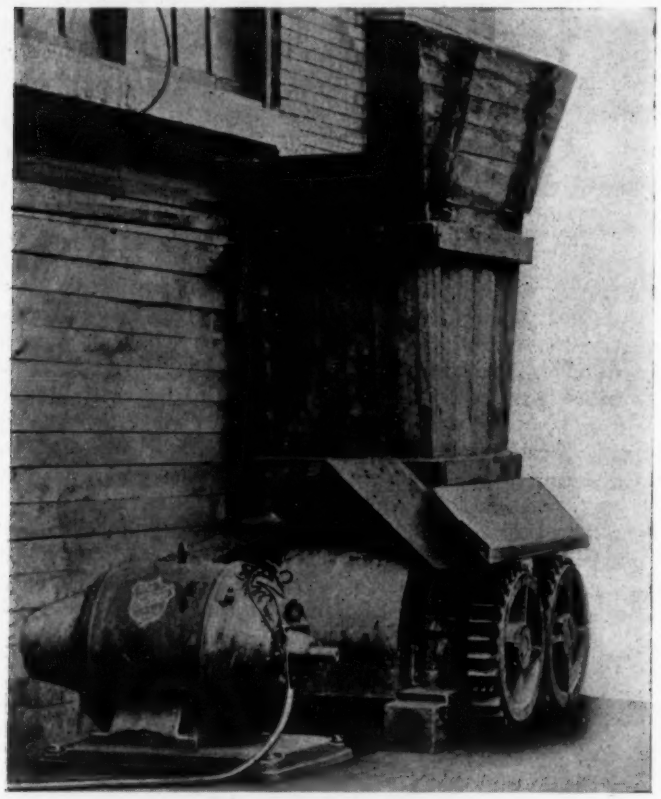


WEATHER-PROOF LAMP.

water. This salt water runs off the walks into the lagoons, and in so doing flows over the lamps and sockets around the base of the walks which encircle the lagoons. It has been found that the ordinary weather-proof lamp sockets will not stand this treatment and be serviceable, so a special socket is employed in which extra depths of porcelain insulation is provided between all live parts of the socket. The socket is also designed so that it sheds water very readily. The Rooney lamp is used in combination with this socket, as shown, and has given excellent results. Heretofore after every heavy storm a very large number of circuits were found defective at Luna Park; but since the change in lamp and socket has been made troubles of this kind have been reduced to a minimum. The lamp can, of course, be employed in any Edison socket with satisfactory results.

Motor Drives for Coal Crushing Rolls.

The accompanying illustration shows a set of 24 x 30-in. Allis-Chalmers coal crushing rolls, belted to an electric motor, such as are now being installed by many users of steam driven power machinery. In connection with furnaces at which automatic stokers are used, or where for other reasons it is desirable to have the coal crushed to a uniform size, the advantages of such an arrangement will be readily apparent. The coal, as it is unloaded from the car, is passed through these rolls and drops to the hopper which feeds the stokers. Where it is possible to secure coal in hopper cars at all times, a further improvement is made



MOTOR BELTED TO CRUSHING ROLLS.

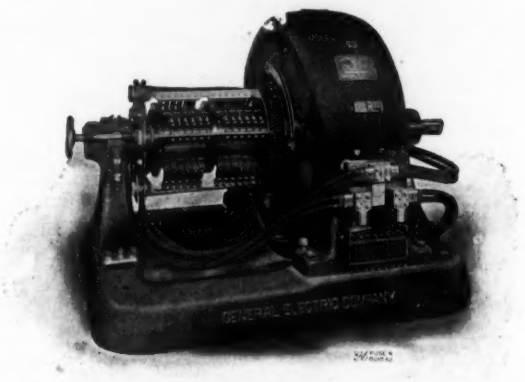
by placing the crushing rolls beneath the track, allowing the coal to drop from the car into the rolls, and to fall from there to the stoker supply hopper. Motor drive is the most satisfactory for an equipment of this character, as such rolls are in operation for a limited time only each day; there is therefore no waste of power, and no idle belt or extra shafting to be cared for while the rolls are not in operation.

The Allis-Chalmers Company is now manufacturing a full line of these rolls, which are used for crushing not only coal, but also rock salt, phosphate rock and other similar materials that do not require the heavy machinery furnished by this company for mining work and the crushing of harder materials. It also builds the motors by which the rolls are driven.

High Speed Motors with High Overload Capacity.

Several interesting motors have recently been installed for testing purposes by the International Steam Pump Company in its new Worthington Hydraulic Works, at Harrison, N. J. The motors were built by the General Electric Company, and are used in testing blowers, pumps, air compressors, etc. They are permanently installed on suitable foundations in such a way that the machinery to be tested can be easily brought up to them. The machines are remarkable because of their high overload capacity and wide speed range for these purposes. The largest of these units is shown in the accompanying illustration. This motor delivers 200 hp at 220 volts running at 750 to 1,500 r.p.m., and 100 hp at 110 volts running at 375 to 750 r.p.m. A similar range in capacity and speed is obtainable with each of the other motors, having full load rating of 100 hp, 30 hp, and 10 hp., respectively, at 220 volts.

All the machines are of the four-pole type and will carry 50% overload for two hours at any speed within the range specified. The motors operate on the three-wire system, the fields being excited from the 220-volt mains, and the armatures being connected through double-throw switches to the 220-volt or 110-volt mains, according to the speed range required. The speed ranges are obtained by field control and the 200-hp and 100-hp machines are built with commutating poles. A German silver resistance, shown just below the terminal board in the illustration, is used



HIGH-SPEED MOTOR.

to make the final adjustment of the current in the commutating field coils. By this arrangement absolutely sparkless commutation at all loads, including even as high as fifty per cent overload, is assured.

Aside from the large capacity and high speed range, these motors have several interesting structural features. On account of the high surface speed of the commutators in the 200-hp and 100-hp machines, an improved shrink ring type of commutator is used. The brush rigging is similar to the form recently adopted in high speed direct-current Curtis turbine-generators. The brush holder studs are of stiff, ribbed design, and the brush holders are secured to the studs by bolts passing through machined joints of special form, making the entire brush system extremely rigid in spite of the unusual length of the studs. The motors are materially lightened by making the magnet frames of steel, and both armature and field coils are built to give proper ventilation at the overload capacity. Particular attention has been paid to balancing the rotating parts so that all vibration within the wide variation of speed and change in load on the machine is entirely eliminated.

There is a wide field among machinery manufacturers for motors of this type having high overload capacity with high speed range, not only for permanent installation for general testing work, as in the case of the machines for the Worthington Works, but also for the driving of machine tools.

Summer Ventilation and Cooling of Laundries.

Air cooling devices are apt to be complicated and expensive, and in the end are not much better than positive means of furnishing air. It is air movement and circulation which brings about the beneficent results desired. Every one recognizes the peculiarly depressing and exhausting effects of a stagnant atmosphere. When we add to this the excessive humidity of the average laundry, we have a combination that is almost unbearable. When the air outside is still or when laundries are so located as to absolutely prevent a free natural circulation of air through the rooms, it is evident that artificial means must be introduced for the purpose. The effect of air movement is to constantly supply dryer air, which greedily absorbs the moisture given off in

perspiration and both the heat and the moisture arising from the work in the room.

For the ordinary purposes of ventilation in winter weather an air change in the average laundry which completely removes the air once in ten to fifteen minutes, would give as good ventilation as it assured in our best equipped schools and public buildings, but this volume is entirely ineffectual to meet summer conditions and to offset the effects of high humidity. For summer ventilation and air movement the maximum time for air change should not exceed five minutes, and it may well be brought down to one or two minutes. This, of course, means large volumes of air, whose movement it would be utterly impossible to secure by natural means. Take a room 30′ x 40′ x 10′ high for instance, and it will be seen that to change the air once in two minutes requires no less than 6,000 cubic feet of air movement per minute. To secure this movement the fan blower or propeller wheel is the only economical device.

An electrically driven ventilating fan of the propeller type, such as is manufactured by the B. F. Sturtevant Co., of Boston, Mass., with specially designed direct-connected motor, will serve the purpose. The fan is proportioned to work at the highest efficiency and is arranged to be enclosed within a cast iron circular casing and supported upon the extended end of an electric motor shaft. This motor, which is of high efficiency, is supported and practically enclosed in the centre of the casing, leaving free passage for movement of air around the same. When practically applied this entire electric fan is bolted to a wall and either forces or drives the air through the opening.

It may thus be utilized either for the purpose of exhausting the warm and moist air from the room or for discharging cool air into it. The method chosen must depend largely upon the conditions. But if the air is to be used solely for cooling and only upon days when this is necessary, the system of forcing the air into the room is most desirable, provided it can be done without causing the air to circulate in such manner as to give rise to too strong a blast upon the occupants.

Otherwise it is better to arrange to exhaust the air of the room and to provide for admission of fresh air from numerous points in opposite position on the other side of the room. This may easily be done through windows or other convenient openings in the walls of the building.

Electric Sturtevant fans of the above type are built with capacities ranging from 2,000 to 175,000 cubic feet of air per minute. The fact that they require no belting or shafting, that the motor is entirely protected from dust, and that the closing and opening of a switch starts or stops, makes of these fans convenient means of improving the summer conditions in laundries.

The Marquette Arc Lamp.

The notable features about the Marquette arc lamp which is here illustrated are its simplicity, ease of repair and substantial character of its parts. Fig. 1 shows the lamp assembled, but with the outer casing removed. Fig. 2 shows the lamp with the series resistance and feeding solenoid removed. Fig. 3 shows the ceiling type of lamp assembled. In this ceiling type of lamp the bottom of the globe only is 24 ins. from the ceiling, and when an inner globe only is used, this is reduced to 20 ins. In Fig. 2 the resistance spool is seen at the left. To insert this resistance, it is only necessary to put one split pin in the top of the lamp from which it is suspended and which serves to make the electrical connection.

The resistance spool is wound on a porcelain drum with a spiral groove on the surface of the drum to receive the wire. A substantial clamp is used to make the adjustable electrical contact by which the amount of resistance in series with the lamp can be varied. At the right in Fig. 2 is the feeding solenoid magnet, on top of which is the dash pot. The feeding of the carbon is accomplished by a simple inclined ring or washer type of clutch acting directly on the carbon. The upper carbon holder consists of a spring socket into which the carbon is forced and in which it is held very positively. This carbon socket is fastened to a piece of porcelain which travels between two round iron nickel-plated guide rods which form the upper framework of the lamp. The top of the lamp is a single casting through which the leading-in binding posts pass in such a way as to be entirely waterproof. All frames and casings are interchangeable. The accompanying illustrations show the direct current lamp. The same frame is used on the alternating current type of lamp.

All of the coils in all of the lamps are suspended from the top by a single cotter pin and held in line at the bottom, in a manner similar to the resistance coil previously described; namely, by single cotter pin suspension. The solenoid dash pot at the top of the magnet coil is entirely closed and protected from dirt or moisture. It is lubricated with dry graphite placed on the top of the plunger. The bottom of the casing above the enclosing globe is a heavy solid piece of porcelain, thus furnishing all the heat resisting and insulating qualities necessary in this place without the complication of porcelain or other bushings and the multiplicity of parts required for insulation when a metal base is used. Taken all together, the lamp is a very simple and substantial piece of apparatus. It is manufactured at 215 S. Clinton Street, Chicago.

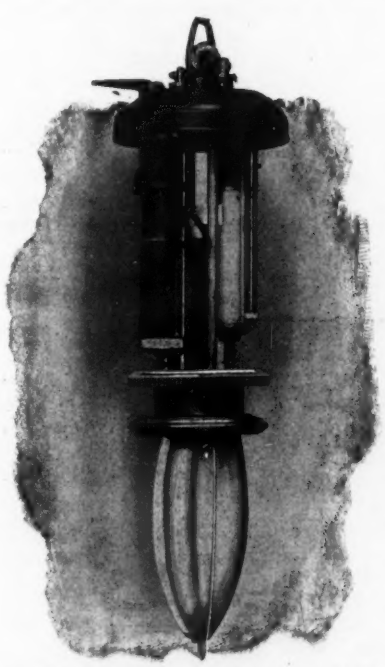


FIG. 1.—LAMP WITH OUTER CASE REMOVED.

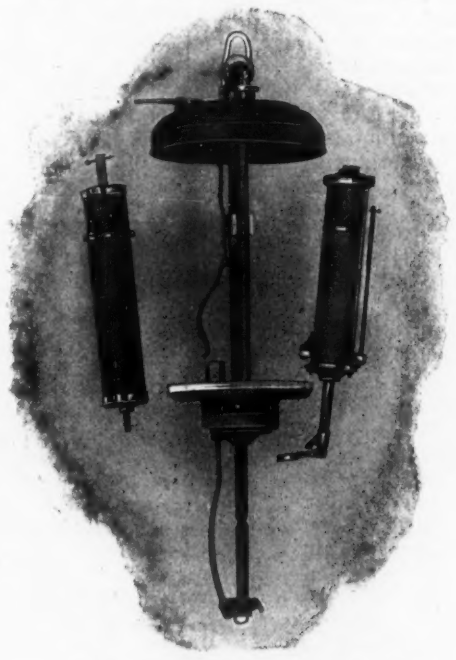


FIG. 2.—LAMP WITH SERIES RESISTANCE AND SOLENOID REMOVED.

FIG. 3.—CEILING TYPE OF LAMP ASSEMBLED.

Industrial and Commercial News

Commercial Intelligence.

THE WEEK IN TRADE.—Reports indicate an active opening of fall trade, buyers having arrived in large numbers at all centres East and West. Free and confident buying of dry goods, boots, shoes, clothing and kindred articles is reported from all Western and Southwestern points, and first and second hands at the East report business of full volume for the season. Other developments have been mainly favorable. Crop reports are favorable, and cotton has been improved by the cessation of heavy rains in the South Atlantic States. The Government crop report, as of August 1, estimates the winter wheat crop at 493,434,000 bushels. The indicated spring wheat crop is 278,830,000 bushels. The total indicated wheat crop is 772,264,000 bushels, which is greater by 24,000,000 bushels than that of 1901, the greatest on record. The indicated corn crop is 2,713,000,000 bushels; the final crop of 1905 was 2,707,993,540 bushels. Industry is very active, the only subject of complaint therein being the scarcity of labor. This complaint, however, is widespread, despite the enormous past and present immigration. Strikes are more numerous, but effects are localized. Iron and steel are in unprecedented demand for a mid-summer period; building and building materials, though less active at New York, show few signs of a let-up at the West, where records of previous years have been broken. Railway earnings continue very heavy, a gain of 12 per cent being indicated for July over a year ago, and bank clearings, while slightly below last week, are much in excess of a year ago. Collections are classed as only fair, and currency shipments to the country are increasing. Commodity prices, except for farm products, which reflect good crop prospects, and some kinds of provisions, are very generally held high for this period. All signs, in fact, point to the trade and industrial stream running very full for this comparatively early stage of the season. Business failures are less numerous, 137 being reported by *Bradstreet's* for the week ending August 9, as against 170 in the week previous and 166 in the corresponding week last year. The world's copper markets exhibit continuously good demands for electrolytic. During the week all domestic producers of high-grade electrolytic metal booked heavily for European account. For British account the week recorded considerable sales of casting copper and some round parcels of Lake. In the home market a number of the wire drawers closed for requirements to the end of the year, and the usual steady going demands from copper rolling, spinning and casting plants were noted among producers. Two important wire drawers are sold up on telephone and telegraph wire as far forward as March next. Prices throughout the copper markets for new and old metal are strong and likely to hold to present prices to the end of the year. Latest large sales were at these prices: Lake, 18¾ to 18⅞c. for September and October; electrolytic, 18½ to 18⅝c., deliveries to be made sixty days off. Casting copper, thirty days, is 18¼ to 18½c.

WESTINGHOUSE FACTORY PLANTS.—The Westinghouse electrical interests now employ 14,705 persons, with 627 in the engineering department. First Vice-president Herr in his recent annual report says: "During this period the East Pittsburg works were twice increased in size and capacity; in 1901-2 by extensions yielding 653,711 sq. ft. of additional floor space. The six-story general office building was also erected in 1901, realizing a further large area of floor space in the works as additional manufacturing space. In 1904-5 these works were again enlarged by the building known as the East Machine Shop, with floor area of 694,943 sq. ft.; also 45,980 sq. ft. additional area, all commanded with powerful electric cranes, in a building connecting this shop with other work buildings. These additions gave the East Pittsburg works nearly four times the original floor space. The Cleveland (Walker) works were changed in 1904 into an iron foundry, admirably equipped, and since then used for the more important foundry work. The rapid growth of the business is now quite fully occupying the facilities of both the Cleveland and Allegheny foundries. The Newark works were completely rebuilt since 1902, and additions were made providing a total floor space of 185,000 square feet. All these additions to the works in East Pittsburg, Cleveland and Newark are now fully equipped with machinery and are prepared to care for the large business now being done, as well as for a reasonable growth. Especial attention has been given to provide adequate facilities for taking care of the rapidly growing and important business in turbo-generators, as well as the building of electric locomotives of all sizes and types, both for special and regular railroad service. The new Sawyer-Man works at Watsessing, N. J., will have 206,700 square feet of floor space, and a large addition is being made to the main factory of the Bryant and Perkins companies at Bridgeport, Conn.

POWER MACHINERY EXPORTATIONS.—The Westinghouse Machine Company, of East Pittsburg, has recently sold to the United States Government for use in connection with the Panama Railroad two compound steam engines; one direct connected to a 325-kw, 250-volt engine type generator, and the other to a 200-kw, 60-cycle, alternating-current, two-phase, 220-volt generator. Both operate under a steam pressure of 150 pounds. Two 165 B.H.P. producer gas engines are to be installed in the plant of the Calgary Milling Company, at Calgary, Alberta, Canada. The engines operate at an altitude of 3,000 feet, using anthracite coal for fuel with possibilty of a change to natural gas as soon as supply is obtained. G. & O. Braniff & Co. have ordered a 300-kw Westinghouse-Parsons steam turbo-generator unit. The turbine will operate on 150-pound steam pressure and 27-inch vacuum, and will be installed in the plant of S. Roberts & Co., Mexico City, Mexico, generating 50-cycle current at 6,000 alternations. The Rio Janeiro Tramway, Light & Power Company will install at Rio Janeiro, Brazil, a 300-kw Westinghouse compound engine unit operating under a steam pressure of 150 pounds and direct connected to a Westinghouse alternating-current generator.

WIRELESS TELEGRAPHY BUSINESS.—The American DeForest Wireless Telegraph Company has issued the following statement in connection with the closing of its offices in Connecticut: "It is true that we are closing down our offices and stations at some points in New England. The station at Hartford has been closed and the office at Bridgeport. We believe, however, that this will be only a temporary arrangement, and all stations we have built in this section will be operated again in a reasonable time. The reason for the interruption of our services at these points may be found in the congestion of work at our station at No. 42 Broadway, New York. For the same reason, the congestion of marine work at New York, it may be advisable to close down other stations now connected with New York and engaged in interurban service. The commercial office at New Haven may very shortly be closed to public patronage, but this is not yet decided. A station will be kept in operation on the Sound for communication with boats. The service from city to city now being interrupted will be resumed as soon as the conditions can be changed in New York, giving a greater capacity. This may be effected by putting up one or more additional stations and introducing duplex apparatus."

BALTIMORE TELEPHONE RATES.—Following reduction in rates by the New England, New York and New York & New Jersey Telephone Companies, another subsidiary of the American Telephone & Telegraph Company, the Chesapeake & Potomac Company announces cheaper rates for Baltimore. The new business rates will take effect September 1, while the rates for residences become effective one month later, October 1. The rates are:

	Old.	New.	Change.
Direct line, flat rate, residence....	$60	$48	$12
Extension station:			
Business message rate.....	12	6	6
Residence message or flat rate...	12	6	6

A reduction from 10 to 5 cents will also be made on toll messages between Baltimore and seven exchanges, going into effect October 1.

PLANT FOR ALABAMA.—The Westinghouse Machine Company, of East Pittsburg, Pa., has recently contracted with the Sheffield Company for a 1,250-kw Westinghouse-Parsons steam turbine to be installed in its plant at Sheffield, Ala. The turbine will run under rather poorer operating conditions than usual; a steam pressure of 125 pounds and 26-inch vacuum. It will be direct connected to a Westinghouse three-phase turbo-generator of the enclosed type delivering current at 2,300 volts to a light and power system.

DULLER EXPORT TRADE.—The report of the exports of domestic products in July, published by the Department of Commerce and Labor, shows a decrease of over $5,000,000 compared with the exports for the corresponding month in 1905. The recent heavy export movement in wheat is reflected in the statement by an increase of $2,748,417 in the exports of breadstuffs. This and a smaller increase in provisions were much more than offset by the reductions in other items, especially in cotton, the exports of which were smaller by nearly $8,000,000. For the first seven months of the year the exports of domestic products show an increase of over $57,000,000 compared with the same period last year. The total for July is $41,193,717 and for the seven months $457,375,471. The figures for manufactured exports for July have not yet been given out.

FAIRBANKS, MORSE & COMPANY, of Chicago, manufacturers of pumps, gas, steam and oil engines, mining and railroad supplies, have recently added to their extensive line of Three Rivers direct-current machinery, a complete line of single and polyphase motors and generators formerly made by the Commercial Electric Company, which they are prepared to ship immediately from stock. This company has now twenty-two houses, the Eastern headquarters being No. 12 Dey Street, New York City.

VIRGINIA WATER POWER.—The Virginia Passenger & Power Company, of which Frank Gould is the principal owner, has completed a canal in Dinwiddie County, Va., at a cost of $200,000, for the purpose of supplying the water power for the company's electric light plant, one of which has just been built at a cost of about $300,000.

GUINLE & COMPANY, Brazilian agents for the General Electric Company, are furnishing a complete plant for long distance power transmission for the cities of Nichtheroy, Cascatinha and Mage, power being received at 44,000 volts by three substations in these places.

Financial Intelligence.

THE WEEK IN WALL STREET.—The stock market had a generally strong tone the early part of the week with continued bullish manipulation in various prominent specialties. The advance in exchange on New York at Chicago, however, caused a reactionary movement, and on Wednesday and Thursday the market was irregular, but on the whole steady. Interest continued to center almost entirely in a few leading stocks, Pennsylvania being probably the most prominent. The United States Steel shares advanced slightly, but receded moderately toward the end of the week. Electric and traction securities followed the course of the general market and exhibited irregularities on small trading. The tone was weak and prices in general took a downward turn. Allis-Chalmers common advanced a fraction, closing at 17⅝, while preferred dropped 2½ points, the last quotation being 46½. General Electric closed at 167, the lowest price of the week, and a net decline of 1½ points. The only transaction in Westinghouse was the sale of 100 shares at 152, which price is an advance of 1 point. American Locomotive common closed at 69 and preferred 113⅞. Business in the tractions was narrow, Brooklyn Rapid Transit closing at 78, a net loss of ½-point and Metropolitan Street Railway at 108, which is an advance of ½. Inter-Metropolitan common closed at 35¼ and preferred 75½, these prices being net declines of 1⅝ and 2 points, respectively. Western Union is off a shade, the closing quotation being 91¼. The last quotations of inactive stocks are as follows: American District Telegraph 25, American Telegraph & Cable 90, American Telephone & Telegraph 125, Electric Storage Battery 86 asked, Havana Electric Railway 52, Michigan State Telephone common 50, preferred 91, New York & New Jersey Telephone 127½, Westinghouse preferred 185 asked. Business on the curb market was a very small affair with the transfer tax restraining activity in the issues of small value. The closing quotations of August 14 are given in the above table.

NEW YORK

	Aug. 7	Aug. 14		Aug. 7	Aug. 1
Allis-Chalmers Co.	17¼	18⅛	General Electric	167	166⅝
Allis.Chalmers Co. pfd.	46¼	46	Hudson River Tel.	...	...
American Dist. Tel.	25	25	Interborough Rap. Tran.	...	...
American Locomotive	69¼	69¾	Mackay Cos.	74	73¾
American Locomotive pfd.	113⅛	113⅛	Mackay Cos. pfd.	72⅛	72¾
American Tel. & Cable	90	90	Marconi Tel.	...	..
American Tel. & Tel.	125	125	Metropolitan St. Ry.	...	...
Brooklyn Rapid Transit.	80⅛	76¾	N. Y. & N. J. Tel.	...	...
Electric Boat	18	18	Western Union Tel.	91⅝	91
Electric Boat pfd	55	60	Westinghouse com.	151	150
Electric Vehicle	10	10	Westinghouse pfd.	...	...
Electric Vehicle pfd.	...	10			

BOSTON

	Aug. 7	Aug. 14		Aug. 7	Aug. 14
American Tel. & Tel.	133	132½	Mass. Elec. Ry. pfd	70	69½
Cumberland Telephone	...	...	Mexican Telephone	...	...
Edison Elec. Illum.	238	...	New England Telephone	...	130
General Electric	...	...	Western Tel. & Tel.	...	...
Mass. Elec. Ry.	20⅛	20	Western Tel. & Tel. pfd.	...	...

PHILADELPHIA

	Aug. 7	Aug. 14		Aug. 7	Aug. 14
American Railways	52	53	Phila. Electric	8	8⅛
Elec. Co. of America	11	11	Phila. Rapid Trans.	30¼	30
Elec. Storage Battery	71⅛	71	Phila. Traction	99	99
Elec. Storage Battery pfd.	...	...			

CHICAGO

	Aug. 7	Aug. 14		Aug. 7	Aug. 14
Chicago City Ry.	160	160	National Carbon	84	86
Chicago Edison	138	...	National Carbon pfd.	117	118
Chicago Subway	46¼	46¼	Union Traction	...	...
Chicago Tel. Co.	...	...	Union Traction pfd	...	...
Metropolitan Elev. com.	28	28			

* Asked

WASHINGTON, D. C., POWER BONDS.—A new bond issue to cover all essential expenses for its new electrical plant is being made by the Washington & Electric Railway Company. The new plant will be able to furnish all the power necessary for any number of manufacturers that may be attracted there, and now that it will not be necessary to buy power from the Capital Traction Company it is thought that there is a great future for the corporation. There will now be disposed of $1,000,000 of a new $7,000,000 bond issue of the Washington Traction & Electric Company, or, more properly speaking, of the Potomac Electric Company, one of the properties of the former organization. This issue is for the purpose of defraying the expense of the new power plant of the company. In 1894, $4,000,000 twenty-five-year gold bonds were issued by this company. Some of the properties now under its control were under different management then. Others that had not been made payable and were not then thought to be desirable are now under the control of this corporation. Of the $4,000,000 bond issue of that year, $1,700,000 were marketed, and the other $2,300,000 were recently cancelled to make way for the new issue. The new power plant of the company will cost just about $1,000,000. The other bonds will be issued as the company needs them for further improvements and operating expenses and for the purposes that the directors may deem necessary. With its new power plant this company will assume an added importance that, it is thought, will very materially enhance the values of its securities. The new plant will have a capacity of about 21,000 hp.

LARGE NEW YORK TRAVEL.—The quarterly statement of the Interborough Rapid Transit Company shows gross earnings of $5,290,164 for the three months ended on June 30 last. This includes both the Manhattan and Subway divisions. The figures show an increase of $741,321 over the corresponding quarter in 1903. The net earnings, including other income, were $3,288,621, and the surplus, after charges, including the 7 per cent guaranteed on Manhattan Elevated stock, was $986,650. This is the sum available for the payment of the interest on the bonds of the Interborough-Metropolitan Company, issued in exchange for Interborough Rapid Transit stock, and for any payments on account of the preferred stock dividend of the former company which the latter may be called upon to supply. The three months' interest on the $70,000,000 of the Interborough-Metropolitan 4½ per cent collateral trust bonds calls for $787,500, leaving a surplus of $199,150 applicable to the dividend on the preferred stock. This is equivalent to about 1¾ per cent a year on the outstanding preferred stock. The Metropolitan Street Railway Company, in other words, will not have to show more than 3¼ per cent earned on its stock in order to supply the amount necessary to pay the 5 per cent dividend on Interborough-Metropolitan preferred. The report of the Metropolitan Street Railway system for the past quarter has not yet been published but it is believed that the earnings have been in excess of this 3¼ per cent rate.

PACIFIC COAST TELEPHONY.—The Pacific States Telephone & Telegraph Company has passed the quarterly dividend, but it is expected that it will be resumed at an early date. Owing to the fire it is impossible to get a correct statement, but the management believes it is earning 9 or 10 per cent on the issued stock. On Aug. 1 there were 11,000 telephones in operation and about 2,000 contracts in hand to fill.

PUEBLO TRAMWAY CAPITAL.—The Pueblo Light & Power Co. has received power from the Dominion government to increase its capital from $3,000,000 to $5,000,000. This is one of the Mexican enterprises formed and fostered by Canadian capital.

TORONTO ELECTRIC ANNUAL.—The report for fiscal year ending December 31, 1905, of the Toronto Electric Company shows profit and loss account as follows:

Revenue from lighting, power, rent, sales, etc.	$775,949
All operating expenses, repairs, etc.	471,319
Dividends	208,937
Surplus for year	95,693

The balance sheet as of December 31, 1905, follows:

ASSETS.

Plant account, including real estate	$2,824,697
Incandescent Light Co., plant, etc.	989,350
Investment account	209,929
Supplies, fixtures in stock	127,815
Accounts receivable, including amount due from city	55,171
Bills receivable	2,000
Insurance paid in advance	2,811
Cash	188,834
Total	$4,400,607

LIABILITIES.

Capital stock paid up	$2,991,910
Debentures	1,000,000
Sundry accounts payable	10,099
Profit and loss account	98,598
Total	$4,400,607

TELEPHONY IN DETROIT.—Advices from Boston call attention as follows to new telephone competition in Detroit, already noted in these columns:—"The Michigan State Telephone Co. is threatened with more rivalry in Detroit. This is due to the formation of the Home Telephone Co. to be financed by the issuance of $3,000,000 6-per-cent bonds. The bonds have been sold through the Electric Construction Co. to the Commonwealth Trust Co., of St. Louis. The promoters are largely St. Louis people with whom are associated the Brailey group of independent telephone promotors. The independent company has been engaged for several weeks in a house-to-house canvass to secure subscribers. Public sentiment, however, seems against a double telephone service, and the new company has obtained only a comparatively small number of subscribers. The Michigan State Telephone Co. has nearly 20,000 subscribers' stations in that city alone and has made arrangements to increase the capacity of the Detroit exchange to 60,000 subscribers' stations. It will spend in Detroit next year over $1,000,000."

BRITISH COLUMBIA ELECTRIC.—The British Columbia Electric Railway has apparently participated in the prosperity enjoyed by the Dominion generally, but owing to the fact that its stocks are not very well known they have not shown any marked fluctuations. The statement for the month of June indicates that the undertaking has an expansion in net revenue of £26,725 for the year, and it seems highly probable that the deferred stock will receive at least 7 per cent for the twelve months, in comparison with 6 per cent for the two preceding years. When anything over 7 per cent is paid on this stock the preferred ordinary ranks for an equal proportion, and on the showing published it seems quite within the range of possibility that 8 per cent on the deferred and 6 per cent on the preferred ordinary could be paid without effort. Despite this, however, the deferred would give 5⅛ per cent on the basis of last year's distribution only, and it appears attractive.

LIGHTING AT ROCHESTER, N. Y.—The Mayor of Rochester, N. Y., has filed with the State Gas & Electric Commission a severe attack on the Rochester Railway & Light Company, alleging charges of extortion, bad gas, inaccurate metering, over capitalization, undue high prices for street arcs and a monopoly contract with the Niagara Falls transmission companies for cataract energy. One clause of the document reads: "That such company is largely over capitalized, being on a $27,000,000 basis, made up of $11,000,000 of capital stock and $16,000,000 of first mortgage bonds; and that, as complainant is informed and believes, the excessive prices charged the consumers of gas and electricity for heat, light and power purposes within the city of Rochester, as above specified, are partly due to the effort on the part of the officers of the company to make dividends and interest charges upon its inflated capital out of the gas and electricity consumers of the city."

LONG ISLAND LIGHTING.—The Nassau Light & Power Company applied to the State Commission of Gas and Electricty, on June 20, for authority to acquire 3,500 shares of the Oyster Bay Company, and a public hearing on the matter was held at Albany on July 6. The Nassau people proposed to take the stock at $7.50 a share, when the par value of the stock is $10. There are but 3,500 shares of the capital stock, and the Nassau company would have had the entire amount if it had been successful in its application to the commission, but the commission has withheld its consent. The Nassau company is under the management of the J. G. White Company, and has already made other consolidations along the North Shore. Its plant, under the efficient management of Mr. K. B. Thornton, was described recently in these pages. Mr. E. D. Morgan is president of the Nassau company, and Mr. Clarence H. Mackay is its vice-president.

RAILROAD TELEGRAPHS.—The following is an item of interest from the *New York Times* on a large field of electrical consumption: "Few persons not directly connected with the management of railroad properties have any idea of the part the telegraph plays in the operation of great railroad systems. A suggestion of the importance of this part of the railroads' equipment is contained, however, in the announcement that the Canadian Pacific has just authorized the construction of 7,000 miles of new telegraph line, for a great part of which the company will use heavy copper wire, and in the report that the Rock Island-'Frisco system is about to reconstruct its telegraph line at a cost of $500,000. Allowing 15,000 miles of road to the Rock Island system, this reconstruction work will call for the expenditure of rather more than $33 a mile for telegraph wires alone."

MISSOURI & KANSAS TELEPHONE.—The decline in Missouri & Kansas Telephone Company stock to 65 is due to the belief that the company may reduce its dividends to a 4 per cent basis. For the year ended December 31 last the company earned only about 1 per cent on its $3,618,800 stock, the balance of the 6 per cent rate being paid out of surplus. The total surplus remaining last December amounted to $293,727, equal to 8 per cent on the stock. The Missouri & Kansas situation has been constantly improving under the management of President Gleed. The company is reaching out and occupying its entire field, and the growth in subscribers' stations has been rapid, amounting to 57 per cent during 1905, and to nearly 30 per cent in the first five months of the present year. In the three years ended December 31 last, over $5,000,000 was expended in developing the property.

MARYLAND TROLLEY MERGER.—The Baltimore & Annapolis Short Line and the Maryland Electric Railway Company have been merged by the organization of the Maryland Electric Railways Company, capitalized at $1,200,000. The outstanding $350,000 stock of the Short Line is to be taken over on the basis of three shares of the Electric Railways stock for one of the new. The terms on which the Maryland Electric Railway Company entered have not been made public. The merged properties will authorize an issue of $8,000,000 5 per cent bonds, of which one-half will be put out as soon as the consolidation is completed. This issue has already been underwritten by local capital.

ROCKY RIVER MORTGAGE.—A mortgage on the plant of the Rocky River Water, Light & Power Company has been given to the United Banking & Savings Company. It is for $20,000, and includes two pieces of property, pumps, boilers, a filtration plant, the mains already laid and those that are to be laid in Rocky River streets, the company's franchise, granted June 3, 1904, and practically all other possessions of the mortgagor. The consideration was $1,400, and the deed was given by W. M. Dean, as administrator of the late Austin A. Bagley. D. C. Reed is president of the power company. R. C. Linder is secretary and treasurer.

LACLEDE POWER UNPURCHASED.—Mr. John I. Beggs, representing the Union Electric Light & Power Company and the North American Company, has denied that any negotiations are in progress for the purchase of the Laclede Power Company, which controls the Edison Electric Illuminating Company, of Carondelet, by the Union Electric Light & Power Company. Officers of the Laclede Power Company also denied the report. The Laclede Power Company is the only independent lighting plant in St. Louis.

KANSAS CITY RAILWAY & LIGHT.—This company for the year ended May 31 showed $5,153,168 gross and expenses, $2,596,539. After adding other income and deducting charges, bonds, retirement, etc., there was a balance of $866,776, of which $476,105 went in dividends. The total profit and loss surplus was $667,351, as compared with $266,680 in 1905. The gross in 1905 was $4,449,134 and in 1904 it was $3,878,359.

SALE OF FROSTBURG PLANT.—The Gas & Electric Development Company, of 1328 Chestnut Street, Philadelphia, reports the sale of the Frostburg gas and electric plants of Frostburg, Md., to Philadelphia parties.

DIVIDENDS.—The American Telegraph & Cable Company's quarterly dividend of 1¼ per cent, guaranteed by the Western Union Telegraph Company, is payable September 1.

TERRE HAUTE TRACTION.—The Terre Haute Traction Company is issuing $500,000 preferred stock. It operates the lighting as well as the traction system.

GENERAL NEWS.

Construction News.

MOBILE, ALA.—H. M. Byllesby & Company, Inc., of Chicago, Ill., have been appointed engineers and managers of the Mobile Electric Company. A new power house will be erected immediately and the lines of the company will be extended and rebuilt.

JACKSONVILLE, ALA.—J. W. Journey has secured the contract for the building, and Ludwig & Company, of Atlanta, Ga., the contract to install the machinery for the electric light plant in this city. The contract for furnishing the material has also been awarded.

CONWAY, ARK.—The municipal electric lighting plant in this city is being enlarged. A new dynamo and engine will soon be installed and the lines extended.

MALVERN, ARK.—The electric light plant owned by S. W. Turner, which was recently destroyed, is to be rebuilt, and bids for the construction will be received until September 30. Probable cost, $9,000.

FRESNO, CAL.—The San Joaquin Light & Power Company is extending its lines to Fowler and will furnish electricity for lighting and power.

SACRAMENTO, CAL.—The Sacramento Gas, Electric & Railroad Company has applied for a franchise to extend its railroad into the south side of the town.

OAKLAND CITY, CAL.—The Oakland City Light & Power Company contemplates installing a 125-kw alternator and the enclosed alternating-current arc lamp system. R. N. Parrett is manager.

LOS ANGELES, CAL.—The Sunset Telephone & Telegraph Company has taken out permits for additions to its buildings on East Jefferson and West Twenty-second Streets, to cost $7,143 each.

RED BLUFF, CAL.—The Board of Town Trustees has granted to the Northern Electric Company a fifty-year franchise to construct and operate an electric railway on the entire length of Main Street.

COVINA, CAL.—Application has been made to the Board of City Trustees (Austin Warner, clerk), for a franchise for electric light, power and heat; bids for same to be received by said board until August 28.

ANAHEIM, CAL.—E. B. Merritt, city clerk, writes that bonds for water works and electric light improvements were sold on July 26, but plans are not yet complete, and no bids have yet been asked for construction.

RED BLUFF, CAL.—The Siskiyou Electric Light & Power Company is preparing to utilize its Fall Creek plant to its fullest capacity, 4,000 hp, by installing three new transformers, an additional generator and another water wheel. A dam 120 feet high will be built, and additional water conveyed to the plant.

PALO ALTO, CAL.—The trustees of the town of Palo Alto, to meet the increasing demand upon the Municipal Electric Light & Water Company, have sold $75,000 of bonds to install additional apparatus in the power house and pumping station. The additions to the equipment will provide 80 per cent more power.

FRESNO, CAL.—A. G. Wishon, of Fresno, manager of the San Joaquin Power Company, writes that permanent surveys are now in progress, and conduit work will commence as soon as same are completed. When nearing completion other work will begin. No contracts will be let, as the company does its own construction work.

VALLEJO, CAL.—The Rio Vista electric light system, which was constructed by J. S. McDonald, of San Francisco, a year ago, has been taken over by a corporation of Rio Vista residents. The new company has elected B. Fleischer, president; Capt. L. P. Larsen, secretary; M. Stewart, treasurer, and L. E. Pollard, of Eureka, as engineer.

ALAMEDA, CAL.—The annual report of Superintendent Kahn of the municipal electric light plant, filed recently, shows total earnings for the year of $74,746, an increase of $10,250 over the total earnings of last year. The operating expenses were $36,455. The plant is to be enlarged immediately by the addition of some $15,000 worth of new machinery, part of which has already arrived.

SAN DIEGO, CAL.—The City Council has granted a franchise to the San Diego Electric Railway Company for an extension of its lines from the intersection of Third and D Streets. The Council has also acted favorably on the petition for electric railway franchises from the Los Angeles and San Diego Beach Railway Company and the South Park and East Side Company, and the franchises will be offered for sale.

DUNSMUIR, CAL.—F. A. Wright, manager of the Drury mine, has contracted with the Siskiyou Electric Light & Power Company to furnish him with power to run the mine, and has also made arrangements to purchase the electric light plants of H. Scherer and F. B. Van Fassen. He will combine these with the contract of the Siskiyou Light and Power Company and furnish a night and day service from Montague south to Dunsmuir. Mr. Wright expects to have the new system running in two or three months.

TRINIDAD, COL.—It is announced that the Trinidad Street Railway Company will build an extension of the local system to Riley Canon, a distance of five miles. F. T. Reed is president.

CANON CITY, COL.—The Colorado Light & Power Company, of Canon City, is reported to have acquired a controlling interest in the plant of the La Bella Mill, Water & Power Company, of Goldfield, which supplies electric power in the Cripple Creek District. It is stated that the capacity of the Canon City plant will be greatly increased.

DANIELSON, CONN.—Plans are under way for the construction of an interstate electric railway between Mooseup, Conn., and Washington, R. I., a distance of 18 miles.

WATERBURY, CONN.—J. E. Sewell, general manager of the Connecticut Railway & Lighting Company states that the company proposes to spend $300,000 in and around Waterbury in the next three years.

WILMINGTON, DEL.—The Street & Sewer Department on August 7 passed the ordinance over the veto of the Mayor granting a franchise to the Commercial Light, Heat & Power Company.

WILMINGTON, DEL.—The Wilmington Light, Power & Telephone Company is preparing to lay a cable across the Christiana River at Third Street, in order to supply the residents of South Wilmington with electricity and telephone service.

WASHINGTON, D. C.—Bids will be received until September 18 at the Bureau Supplies and Accounts, Navy Department, Washington, D. C., for erecting on the light house reservation at Table Bluff, Cal., Cape Blanco, Cal., and North Head, Ore., a combined operating and dwelling house, power house, oil house, water tank, walks, piping, etc.; and for the transportation from the Navy Yard, Mare Island, Cal., and erecting on the sites of wireless telegraph masts and rigging. Applications for proposals should refer to Schedule 93. Bids will also be received until September 1 for two air compressors and accessories for the navy yard, Charleston, S. C. Plans and specifications can be seen at this bureau or will be furnished by the commandant of the navy yard at Charleston, S. C. H. T. B. Harris, Paymaster-General, U. S. N.

WASHINGTON, D. C.—Bids will be received until August 21 by the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., for furnishing at the Navy Yards, etc., Portsmouth, N. H.; Boston, Mass.; Newport, R. I.; New York, N. Y.; League Island, Pa.; Annapolis, Md.; Washington, D. C., and Norfolk, Va., a quantity of naval supplies as follows: Schedule 81—Deck and bulkhead fixtures, testing generators, ventilating sets, vacuum drying apparatus, electrical compound, etc. Schedule 82—Wattmeter, incandescent lamps, electrical supplies, etc. Schedule 83—Electrical cable, conduit and fittings, galvanized steel, sheet zinc, etc. Schedule 84—Motors, etc. Schedule 85—Hydraulic jacks. Applications for proposals should designate the schedule desired by number. H. T. B. Harris, Paymaster-General.

AUGUSTA, GA.—The City Council has granted the Anthony Shoals Power Company a 30-year franchise to use the streets of the city for its lines.

CULDESAC, IDA.—W. L. Kimmel, of Spokane, Wash., representing the firm of Nixon & Kimmel Electrical Company, has been in town making preliminary arrangements for the construction of the new electric lighting plant. It is stated that the plant will be equipped with Westinghouse machinery.

BOISE, IDA.—J. H. Hollister announces that the General Electric Company, of which he is the head, has secured control of all the large power sites along the Snake River, except the one at Swan Falls, and that it is the purpose of the combination to supply power to Salt Lake City and points in Utah and throughout the Snake River Valley. J. H. Brady, of New York, is interested in the enterprise.

BOISE, IDA.—It is reported that plans are being made for the construction of a large power plant on the Snake River at Ox Bow Bend, Baker County, Ore., south of Spokane, where Dominicus J. Wilson, of Boise, Ida., has given notice of appropriation of 8,000 cubic feet per second of the flow of the river for that purpose. He has formed the Snake River Power Company and intends to supply power for the Seven Devils, Sumpter, Greenhorn, Elkhorn mining districts, also electrical power for the towns of Ontario, Weiser, Payette, Huntington, Sumpter, Baker City and settlements in Oregon and Idaho.

ELGIN, ILL.—Plans are being made for the proposed new switchboard for the lighting of the county buildings.

QUINCY, ILL.—The County Home Telephone Company has increased its capital stock from $2,500 to $500,000.

PEORIA, ILL.—It is reported that the Peoria Gas & Electric Company has decided to spend $250,000 in improvements.

MT. PULASKI, ILL.—The Mt. Pulaski Telephone Company has filed amendments to its charter increasing its capital stock from $5,000 to $50,000.

CARMI, ILL.—The citizens are contemplating rebuilding the lines of the municipal electric lighting system. G. Clinton Smith is superintendent.

BLOOMINGTON, ILL.—The Railroad Committee has recommended that a 20-year franchise be granted to the Illinois Traction Company, the holding company of the Bloomington & Normal Railway & Light Company, to furnish electricity for the operation of 400 arc lamps for the city of Bloomington.

RICHMOND, IND.—The directors of the Home Telephone Company have purchased a new site and will erect a large building and install an automatic system in this city.

HOPE, IND.—J. E. Guffey, City Clerk, announces that the finances have been secured and the city officials will soon proceed to the construction of a municipal water and light plant.

GREENWOOD, IND.—The Citizens' Water & Light Company will extend its lines to Southport, a distance of three and a half miles, and will furnish an incandescent street service. J. A. Craig is manager.

TERRE HAUTE, IND.—The Terre Haute Traction & Light Company is adding a 150-kw turbine and building a transmission line to Brazil; a sub-station will also be established. C. T. Mordock is resident manager.

FORT WAYNE, IND.—Joseph Harris, vice-president of the Automatic Electric Company has purchased the plant of the Independent Telephone Company at South Bend. It is stated that $100,000 will be spent in extensions to the plant.

ROCKVILLE, IND.—Extensive improvements and additions will soon be made in the municipal electric lighting plant. A 120-kw, single-phase, 60-cycle General Electric alternator and an engine of about 100 hp capacity will be installed. E. G. Lanning is superintendent.

INDIANAPOLIS, IND.—Charles S. Norton, secretary of the New Long Distance Telephone Company, reports that an unusual large expenditure of money is being made in the betterment of telephone properties in Indiana; appropriations have been made for improvements as follows: At Clinton, $35,000; Covington, $10,000; Columbus, $9,000; Franklin, $7,000; Indianapolis, $17,600; Richmond, $150,000; Wabash, $40,000, and Trafalgar, $3,000.

MUSKOGEE, I. T.—The Muskogee Ice & Power Company is contemplating installing 1,000-hp in boilers and a condensing outfit. H. H. White is manager.

MUSKOGEE, I. T.—The City Council contemplates constructing a dam in Grand River and has contracted for 700 hp to be used in the municipal plants now being operated by steam. The water power plant is to have a capacity of 10,000 hp.

MANCHESTER, IA.—A new engine of 100 hp and an additional McCormick turbine is now being installed in the electric lighting plant owned by E. W. Hoag.

KNOXVILLE, IA.—The Knoxville Electric Company expects to install a 50-kw generator and engine in its plant before the end of this year. P. E. Bellamy is manager.

GARNER, IA.—The Enterprise Electric Light, Heating & Power Company is considering the question of installing storage batteries in its plant. C. T. Schneider is manager.

EMMETSBURG, IA.—The Emmetsburg Electric Light, Heat & Power Company is contemplating changing its street lighting system from direct to alternating current. John McNamara is owner.

DENISON, IA.—The Denison Electric Light & Power Company is contemplating an addition to its power house and will install a 50-kw alternator, an engine of 100 hp capacity and also a 100-hp boiler. N. J. Wheeler is manager.

ST. ANSGAR, IA.—The Wood Working Machinery Company is contemplating moving the electric light plant to the river to be operated by water power. The company will construct a concrete dam with nine foot head and will commence work about May 1, 1907. C. H. Miller is manager.

LEAVENWORTH, KAN.—The Peoples' Home Telephone Company proposes to build an entirely new plant in this city. W. P. Feth is the architect.

DODGE CITY, KAN.—The Midland Water, Light & Ice Company contemplates installing a series alternating-current street lighting system. George Theis, Jr., is president and manager.

ARKANSAS CITY, KAN.—The Arkansas City Gas & Electric Light Company is contemplating doubling the capacity of its plant within the next year. A. L. Newman is secretary and manager.

LAWRENCE, KAN.—The Lawrence Electric Light Company has just completed the rebuilding and equipping of its power station and the erection of 25 miles of new pole line. J. T. Skinner is superintendent.

TOPEKA, KAN.—At a meeting of the Board of Directors of the Topeka Electrical Company, held August 7, the franchise was accepted which was granted to the company by the Council, July 11. An order for the electrical machinery will be placed immediately. Two power houses will be built, one for furnishing electric light, and the other for power for manufacturing purposes. The company expects to have the plant completed and in operation by the first of the year. C. R. Maunsell is interested.

MADISONVILLE, KY.—W. C. Morton is reported to be preparing estimates for an electric light plant. Jas. L. Brown is city clerk.

ALBION, KY.—The Albion Water Works Company has secured the Elliott mill near Albion and will build a dam to generate electricity.

CORBIN, KY.—The Horne Electric Light Company is planning to double the capacity of its plant this fall. J. C. Mershon is manager.

HARRODSBURG, KY.—The citizens are contemplating increasing the power capacity of the municipal electric lighting plant. L. C. Riker is manager.

VANCEBURG, KY.—The Vanceburg Electric Light, Heat & Power Company will install a 60-kw dynamo in September. G. P. Adams is superintendent.

CATLETTSBURG, KY.—The Carpenter Electric Light & Power Company contemplates installing magnetite arc lamps for street lighting. D. H. Carpenter is president.

LEWISPORT, KY.—Jesse Emmick is contemplating installing a storage battery in his electric light plant and wishes to secure prices on small direct-current motors of ½ to 2 hp capacity.

PADUCAH, KY.—The Board of Public Works has let the contract for a 45-kw General Electric generator and 200 magnetite lamps to be installed in six weeks. J. A. Keebler is superintendent.

PADUCAH, KY.—The Home Telephone Company is making extensive improvements to its system in this city and surrounding country. The company is spending $160,000 in the city and $400,000 in western Kentucky.

MAYFIELD, KY.—The Mayfield Water & Light Company is contemplating the erection of a new power house and installing a 400 or 500 kw direct-connected unit and extension of mains. J. W. Landrum is secretary and manager.

COVINGTON, KY.—On August 4, the City Council passed ordinances providing for the construction of an electric light plant according to plans prepared by Owen Ford, of St. Louis, Mo., and that bids for the construction of the plant be asked; also that bids be asked for the operation of the plant after it is constructed.

LOUISVILLE, KY.—The Louisville & Southern Indiana Traction Company has filed a petition with a Board of Commissioners of Floyd County, at New Albany, asking for a right-of-way over and across all of the roads of the county. Should the petition be granted the company will begin work at once laying tracks from the terminal of the State Street line in New Albany to the foot of the Mooresville knobs. The company contemplates building as soon as practicable extensions both to Corydon and the French Licks Springs.

LAFAYETTE, LA.—The City Council has authorized the Committee to receive bids for an extension of the arc lighting system, about 90 in number, at an approximate cost of $10,000; an extension to the water works system to cost $7,000, and the construction of a new brick power house for the plant, to cost $5,000.

BANGOR, ME.—The Postal Telegraph-Cable Company will shortly make a radical change in its Bangor office by the installation of two dynamos to take the place of the common cell batteries now in use.

PORTLAND, ME.—At a meeting held August 6, the City Council voted to recommend the cancelling of the present contract with the Portland Electric Light & Power Company, and that a new contract be made for 20 years.

CAMERON, MD.—The citizens have voted to issue bonds for the improvement of the electric light plant and for extending the water works.

HAVRE DE GRACE, MD.—The Havre de Grace Electric Company has just completed the installation of a 150-kw Westinghouse generator direct connected to Westinghouse standard engine. Wesley W. Reynolds is president.

ELLICOTT CITY, MD.—The Patapsco Electric & Manufacturing Company is constructing a large plant on the Patapsco River between Fletcher and Orange Grove. The plant will be operated with water power with steam auxiliary, and will have a capacity of 1,500 hp. Otto Wimder is superintendent.

POCOMOKE CITY, MD.—The Stevenson Electric Light Company is remodeling its plant, changing from the two-wire to three-wire system. A contract has been placed with the Westinghouse Electric & Manufacturing Company for a 70-kw, direct-current, three-wire, 220-volt generator to be installed and in operation by the middle of September. R. P. Stevenson is manager.

BALTIMORE, MD.—The Maryland Telephone & Telegraph Company is making extensive improvements to its plant on Gould Street. Contracts have been awarded to the Sterling Boiler Company for new boilers, which will increase the boiler capacity 50 per cent; more generators will be installed, which will give the capacity of the plant 16,500 hp when completed. The company is also getting its sub-station on Linden Avenue in working order. The company is increasing the capacity of its plants to provide for new contracts it has secured, many of which will take effect early in the winter.

GREENFIELD, MASS.—The Greenfield Electric Light & Power Company is installing a new 655-hp Sterling boiler in its power station.

WOBURN, MASS.—John H. Flinn, city clerk, writes that only preliminary steps have been taken in the matter of constructing a municipal lighting plant.

WORCESTER, MASS.—The Worcester Electric Contracting Company, of 268 Main Street, has secured the contract for wiring the Worcester Free Public Library for electric lamps.

LOWELL, MASS.—The Lowell & Woburn Street Railway Company has been authorized by the Railroad Commission to issue $36,200 capital stock at par, the proceeds to be used for construction and additions.

NORTH ABINGTON, MASS.—The Electric Light & Power Company, of Abington and Rockland, will soon install a new 300-kw generator in its plant in this place to meet the demands of its increasing business.

FITCHBURG, MASS.—The Fitchburg Gas & Electric Light Company is considering installing a new McIntosh-Seymour engine direct connected to a 1,000-kw General Electric alternator. H. F. Coggshall is treasurer and manager.

ASHBURNHAM, MASS.—A statement certifying to an increase of capital stock by $6,000 has been filed by the Greene Electric Light, Power & Manufacturing Company. Charles H. Greene is president and Alonzo A. Carr is treasurer.

UXBRIDGE, MASS.—The Uxbridge & Northbridge Electric Company contemplates installing a larger engine, increasing its boiler capacity and substituting three-phase dynamos for single-phase and changing primary voltage to 2,080 volts.

SALEM, MASS.—The Salem Electric Lighting Company is extending its alternating-current motor service to the manufactories of the city. Several motors have already been put in, and orders are ahead for 15 more, of from five to 15 hp.

MANSFIELD, MASS.—A new 225-hp Deisel engine, a 150-kw, two-phase, revolving-field Fort Wayne generator, with switchboard equipment, etc., are now being installed in the municipal electric lighting plant, which, when completed, will double the capacity of the plant. George Wood is manager.

BROCKTON, MASS.—The Edison Electric Illuminating Company is planning to extend its lines to East Bridgewater and will install 69 25-cp incandescent street lamps, and will also furnish electricity for commercial lighting and power. The company will also install a 3,000-hp Kendall boiler. A. F. Nelson is superintendent.

WEST SPRINGFIELD, MASS.—The Selectmen have awarded the contract for lighting the streets to the United Electric Light Company, of Springfield, for a period of three years. The company is to furnish arc lamps for $73 per year, which is $2 less than is now paid, and incandescent lamps for $15 per year. The company also is to pay the town 10 per cent of the receipts from commercial lighting in return for the use of the poles and wires, which are owned by the town.

HOPKINTON, MASS.—At a special town meeting held August 3, the committee appointed last March to look into the matter of securing an electric lighting plant for Hopkinton, made its report, which includes estimation of the cost of establishing a municipal lighting plant, also detailed figures for light and power service from the Edison Electric Illuminating Company. The committee recommended the Edison plant in preference to the municipal. It was voted to accept the report and adopt the recommendation of the committee.

ESCANABA, MICH.—A new Sterling boiler is being installed in the municipal electric lighting plant. John Roemer is manager.

IMLAY, MICH.—The Imlay City Electric Light Company is considering the installation of a new engine. Ernest A. Ross is president and manager.

HARTFORD, MICH.—Anderson Brothers, owners of the electric light plant, are considering the installation of 75-hp engine and boiler, also a 40-hp motor.

DETROIT, MICH.—The Public Lighting Commission is contemplating installing 350 additional arc lamps in the municipal street lighting system. William Daly is superintendent.

SEBEWAING, MICH.—John C. Liken & Company contemplate putting in a new Reynolds Corliss engine for operating the electric lighting system. Richard Martin is treasurer.

ST. CLAIR, MICH.—The Board of Public Works has asked for bids for two new water-tube boilers of 200-hp capacity each for the municipal electric lighting plant. S. E. Padfield is superintendent.

CRYSTAL FALLS, MICH.—The citizens are discussing the question of installing General Electric series alternating-current arc lamps in the municipal electric lighting system. Q. Stephany is superintendent.

MANCELONA, MICH.—The Mancelona Electric Light & Power Company will change its system from direct to alternating current; power will be furnished by a hydro-electric plant on Cedar River, seven miles distant, which is now under construction and will be completed within two months. The company will need transformers, meters and alternating-current arc lamps. Fred Wildi is owner and manager.

AURORA, MINN—S. S. Hough, of Eveleth, has petitioned for a franchise for an electric light plant in this town.

ANOKA, MINN.—The Anoka Water Works, Electric Light & Power Company is considering the installation of a new dynamo. F. H. Philbrick is secretary and manager.

MINNEAPOLIS, MINN.—A permit has been issued to the Tri-State Telephone & Telegraph Company for the erection of a building at Twenty-sixth St. and Pillsbury Ave., to cost $14,000.

ROCHESTER, MINN.—A new generator made by the Western Electric Company and a new boiler have recently been installed in the municipal electric lighting plant. J. A. Eichinger is superintendent.

CROOKSTON, MINN.—The Crookston Water Works, Power & Lighting Company will build next year a 40-foot dam 12 miles above the city, and will develop about 6,000 hp. The company will distribute electricity throughout the Red River Valley of the north. E. Petersen is superintendent.

DULUTH, MINN.—The City Council has adopted a resolution asking the city engineer to prepare an estimate of the cost of an electric lighting plant, complete in every detail; also estimates for a plant with electricity furnished by the Great Northern Power Company; an appropriation of $3,000 was made to secure the services of an expert electrical engineer to assist the city engineer in preparing the estimate.

COLLINS, MISS.—An additional boiler of 100 hp has been installed in the municipal electric lighting plant recently. H. Swinney is manager.

BROOKHAVEN, MISS.—The awarding of a contract to enlarge the water works and light plant has been postponed by the City Council until the September meeting.

ELLISVILLE, MISS.—The citizens are contemplating installing a feed heater and pump and may also install an engine in the municipal electric light and water plant. C. E. Shannon is superintendent.

ST. LOUIS, MO.—The Southeast Missouri Telephone Company has increased its capital stock from $150,000 to $300,000.

INDEPENDENCE, MO.—The Light Committee is contemplating installing a 50-kw, direct-connected alternator; a 300-hp condenser and new extensions of line. B. F. Wallace is superintendent.

LOUISIANA, MO.—The Louisiana Gas & Electric Light Company is contemplating changing its system to 60 cycles, 2,300-volt, three-phase for power circuits and increasing the capacity of the plant 50 per cent. D. Turnbolt is president and manager.

CAPE GIRARDEAU, MO.—A large addition is being built to the power station of the Cape Girardeau Water Works & Electric Light Company. The company is installing new boilers, new engine and a new General Electric generator; and is also erecting a $25,000 gas plant, which will be in operation by November 1, 1906. Thomas Fox is manager.

ST. LOUIS, MO.—The Hillsboro, Kimmswick & Northern Railway Company has been granted a franchise by the County Court at Hillsboro, to construct its lines. One line will extend from Meramec to Kimmswick, and the other from Kimmswick to Hillsboro. The St. Louis, Hillsboro & Southern also has applied for a franchise on a line from Hillsboro to St. Louis.

VERSAILLES, MO.—An election was held in this city August 7; the citizens voted that the city should set aside its present electric lighting system and buy electricity from a company to be organized to furnish energy from the Gravois, a stream ten miles distant. The present electric light system has been in use two years, but it is proposed to furnish the city with much cheaper light from this water power.

HAVELOCK, NEB.—A new electric lighting plant will be established here in the near future.

NEBRASKA CITY, NEB.—The Council, it is stated, is considering the establishing of a municipal electric light and water plant.

FREMONT, NEB.—S. F. Stiles, city clerk, writes that the citizens voted August 1 to construct an electric light plant. J. N. Andrews is engineer.

AUBURN, NEB.—The Auburn Mutual Lighting & Power Company has recently purchased a 140-hp Murray Corliss engine to increase the capacity of its power plant. C. A. Snider is superintendent.

CARSON CITY, NEV.—Application for an electric railway franchise in Ormsby County and in Carson City has been filed by P. V. Mighels, S. P. Davis, J. B. Viera and F. L. Wildes.

LACONIA, N. H.—Work has commenced on the new addition of the Laconia Electric Light Company at the Lakeport end of the city. The addition will be of brick, 60 by 40 feet, and two stories high. Another 250-hp Deisel engine will be installed and also a 200-kw generator.

ROCKAWAY, N. J.—The city is contemplating the purchase of the plant of the Rockaway Electric Light & Improvement Company, and an expert is to be appointed to determine the value of the plant. The citizens recently voted $35,000 bonds for electric light improvements.

LAS VEGAS, N. M.—The Las Vegas Railway & Power Company is contemplating rebuilding its electric lines. William A. Buddecke is president and manager.

LAS CRUCES, N. M.—The Las Cruces Electric Light & Ice Company expect to install next season an alternating system of 125 kw capacity, and a 100-hp boiler in its plant. B. L. Berkey is president and manager.

DELHI, N. Y.—F. K. Baxter, of Utica, is laying out an electric railway from Delhi to Bloomville, a distance of about eight miles.

AMSTERDAM, N. Y.—The contract for lighting the streets of the city has been awarded to the Central Power Company, of Utica, for a period of five years. The company is to furnish arc lamps at $39 per lamp per year, including the building of a conduit system.

LEWISBURG, OHIO.—This city will vote on the question of municipal ownership of a water works and electric light system in the near future.

FOSTORIA, OHIO.—The Board of Public Service has placed a contract with the City Heat & Light Company for 90 arc lamps at $69.25 per lamp. Under an old contract the city paid $90 per lamp.

LIMA, OHIO.—The Western Ohio Railway is securing a right of way from Macbeth Park to the end of Market Street, for the purpose of securing a new entrance to Lima.

EAST LIVERPOOL, O.—Willis Davidson, City Auditor, writes that the city contemplates in the near future taking steps to construct a municipal electric light plant. Estimates of the probable cost are to be secured at once.

TOLEDO, OHIO.—The Maumee Valley Railway & Light Company is planning to extend its Waterville branch line, known as the Toledo, Waterville & Southern from Waterville to Grand Rapids, O., a distance of about 12 miles.

CLEVELAND, OHIO.—The Forest City Street Railway Company has secured the site for its power house on the Cuyahoga River near Willard Street. Plans have been completed for the building and temporary generating equipment has been ordered. A. B. DuPont is manager.

SPRINGFIELD, OHIO.—Plans are being made by the Indiana, Columbus & Eastern Company to double-track the line of the Dayton, Spring-

field & Urbana between Dayton and Springfield in the near future. A large turbo-generator is being installed in the Medway power station.

CLEVELAND, OHIO.—General Manager Beatty, of the Eastern Ohio Traction Company, states that the reorganization of the company is assured without the formality of a court sale. The reorganization plan involves the building of a new line from Chagrin Falls to Garrettsville, a distance of 17 miles; also the practical rebuilding of a greater portion of the Eastern Ohio system, including the installation of new cars and additional power equipment.

SHAWNEE, OKLA.—The Shawnee Lighting Company is now installing a 500-kw alternator and a 300-kw, direct-current railway generator in its plant to meet the increased demands for service. J. C. Fisher is secretary and manager.

GUTHRIE, OKLA.—The Red River Power & Traction Company proposes to build an electric interurban railway parallel to the Red River from a point near Waurika, Okla., to Ardmore, I. T. C. C. Galloway, of Ardmore, is secretary and treasurer.

EL RENO, OKLA.—The Pioneer Telephone Company has purchased the entire holdings of the El Reno & Topeka Telephone Company. The officers elected for the first named company are as follows: E. D. Nims, president; Henry Asp, vice-president; E. E. Westervelt, treasurer; J. M. Noble, general manager; J. F. Bezdecheck, district manager. The new company will rebuild the local exchange and greatly improve the system.

PORTLAND, ORE.—The Pacific States Telephone Company will erect three new telephone exchanges in different parts of the city.

LEBANON, ORE.—The Lebanon Light & Water Company is contemplating installing a new 100-hp turbine and will establish a day service. J. S. Hughes is owner and manager.

PORTLAND, ORE.—A movement is on foot for the construction of an electric railway from Salem to Mehama. The line has already been surveyed and the right of way is now being secured. A. Welch is interested in the project.

NEWBERG, ORE.—The Yamhill Electric Company is now installing a 200-kw, three-phase, 60-cycle General Electric alternator and a Reliance Corliss engine in its plant, to replace the engine and dynamos now in use. The company expects to establish a day service about September 1. C. J. Edwards is manager.

WAYNESBURG, PA.—Plans are being formulated for the erection of another power plant in this city.

YOUNGSTOWN, PA.—A municipal electric lighting plant will soon be erected in this city at a cost of $150,000.

BELLEVUE (P. O. ALLEGHENY), PA.—The Borough Council on August 7 voted to grant a 5-year contract to the Ohio Valley Light Company. The present contract with this company expires December, 1907.

NORTHUMBERLAND, PA.—The Sunbury & Northumberland Electric Railway Company will soon install a 500-hp engine and an alternator in its plant. Orders for the machinery have been placed. C. J. Callahan is president and manager.

BLAIRSVILLE, PA.—Two new boilers made by the Phoenix Iron Works Company are now being installed in the plant of the Citizens' Heat, Light & Power Company, making a total boiler capacity of 380 hp. L. B. Rhodes is manager.

ALTOONA, PA.—The Edison Electric Illuminating Company is installing an 800-hp McIntosh-Seymour engine in its plant at Union Avenue. The company will also install a generator of 800 kw capacity; later on a 600-kw motor generator will also be installed in the plant.

EPHRATA, PA.—Extensive changes and improvements are to be made to the municipal electric lighting plant. The system is to be changed from direct to alternating current. The city has contracted with the Westinghouse Electric & Manufacturing Company for a 100-kw, three-phase, 60-cycle, 2,300-volt alternator with switchboard and equipment. The lines are to be rebuilt and 36 series arc lamps will be installed. The above improvements will cost about $5,000. S. L. Sharp is superintendent.

PROVIDENCE, R. I.—The Narragansett Electric Lighting Company has reduced its minimum charge for electricity for one-hp motors from $5 to $1 per month. For motors of larger size the new charge will be 50 cents for each hp up to 10-hp, and the minimum charge for motors of more than 10-hp will be $5 per month.

CHARLESTON, S. C.—Bids will be received until September 1 by Mordecai T. Endicott, Chief Bureau Yards and Docks, Navy Department, Washington, D. C., for two air compressors and accessories for the Navy Yard, Charleston.

MITCHELL, S. D.—The plant of the Mitchell Gas Company is to be enlarged; an engine, boiler and dynamo will be purchased.

YANKTON, S. D.—The stockholders of the Independent Telephone Company have voted to amend its articles of incorporation and increase its capital stock to $500,000.

MADISON, S. D.—The citizens are considering the question of installing a series incandescent street lighting system with station regulator in the municipal electric lighting plant this fall. Roy Fulkerson is manager.

COVINGTON, TENN.—The citizens are considering the question of installing new boilers and engine in the municipal electric light plant. John Craig is manager.

NASHVILLE, TENN.—At a meeting of the stockholders of the Nashville Railway & Light Company, on July 18, the issuance of $15,000,000 in bonds was authorized. Of this amount $7,500,000 will be issued at once, with which to retire $6,000,000 outstanding bonds and allow $1,500,000 for improvements in the railway and light plants.

WEATHERFORD, TEX.—The Weatherford Water, Light & Ice Company is increasing the capacity of its plant by installing a new alternating-current generator. S. O. Newton is manager.

DALLAS, TEX.—A contract was closed August 6 for the construction of an electric line to connect the Texas Agricultural & Mechanical College at College Station, with the town of Bryan. The line is to be completed within a year.

EL PASO, TEX.—The International Light & Power Company has changed its name to the El Paso Electric Railway Company. The company is making many changes and increasing the capacity of the plant. C. W. Kellogg is manager.

LAREDO, TEX.—The Cannal Coal Company has just closed a contract to have a complete electric plant installed at its mines, twenty miles above Laredo, at a cost of $30,000. All work in the mines will be done by power furnished by electric motors.

OGDEN, UTAH.—The Salt Lake & Ogden Railway Company is planning to erect a power station in this city.

PROVO, UTAH.—An electric lighting plant is to be constructed here at a cost of $50,000. Willard Young and Frank C. Kelsey, of Salt Lake City, Utah, and Portland, Ore., are the engineers; J. P. Bott is chairman Lighting Committee. No date has yet been set for receiving bids for construction.

JAMAICA, VT.—H. A. McLean & Company, owner of the electric lighting plant, contemplate extending its lines to Townshend, Vt.

MARTINSVILLE, VA.—The municipal electric light plant on Smith River has been completed and the lights were turned on August 5. The town has 450 hp for sale, besides having sufficient power for all lighting purposes.

PETERSBURG, VA.—The Virginia Passenger & Power Company has just completed a canal which is to supply the water for operating the two electric plants of the company in Petersburg at the locks in Dinwiddie County. The total cost of the canal and the new plant at the locks is about $500,000.

ALEXANDRIA, VA.—Mayor Fred J. Paff, it is stated, has signed the contract with the Alexandria Electric Light Company for the lease of the electric light franchise for a term of 30 years. The work of constructing the plant, which will cost about $75,000, will soon be commenced. W. L. Nathues, of Media, Pa., is president; E. E. Mandeville, of Philadelphia, Pa., is secretary.

SPOKANE, WASH.—Farmers living near Harrington, Wash., west of Spokane, have completed arrangements for lighting their ranch houses with electricity. They will also light their barns and stables.

SEATTLE, WASH.—The City Council has passed an ordinance calling for a special election, to be held September 12, to vote on the issuance of $4,273,000 worth of bonds for a municipal street railway system and the extension and enlargement of the Cedar River water system.

SPOKANE, WASH.—Surveys have been completed and 75 per cent of the 120 miles of way has been secured for the electric railway between Spokane and Davenport, Wash., which is to be built by the Spokane & Big Bend Electric Railway Company. W. H. Plummer is president.

SPOKANE, WASH.—The Pend d'Oreille Development Company, Spokane, writes that it is proposed to construct a power plant about 1¾ miles below Metaline on the Pend d'Oreille River, but the work is only in preliminary stage, and active construction work will not begin until January 1st, 1907.

SEATTLE, WASH.—The Seattle Electric Company has been granted a franchise to build an electric railway along Railroad Avenue in West Seattle beyond Sandy Beach; also a franchise to extend the line from the end of the present municipal system on California Avenue to Lincoln Beach to Alki Point, with a loop through West Seattle.

FT. WORDEN, WASH.—Bids will be received until August 31 by Lieut. Charles A. Clark, Acting Chief Quartermaster, U. S. A., for furnishing material and installing fixtures, wiring buildings, making changes in present wiring, making service connections, furnishing watt-hour meters and installing watt-hour meters in building for electric lighting at Ft. Worden.

SPOKANE, WASH.—Jay P. Graves, president of the Inland Empire Electric Railway Company announces that the line of the Spokane & Inland Railway will be extended from either Moscow, Ida., or Palouse, Wash., to the Snake River. Work will begin the coming fall. It is also announced that a line from Spokane to Lake Pend d'Oreille, Ida., a distance of 56 miles, will be in operation in a year.

SPOKANE, WASH.—A trust deed for $3,000,000 has been filed in Spokane County by the Home Telephone & Telegraph Company, of Spokane, in favor of the Title Insurance & Trust Company of Los Angeles, Cal., the document being signed by Charles E. Sumner, president. The company has bought a site for $25,000 in the business district, and it is announced a $60,000 office building will be erected the coming fall.

SEATTLE, WASH.—The Hanford Power & Irrigation Company, of Seattle, has purchased land on the Columbia River at Lower Priests Rapids, and expects to construct an electric plant and to furnish electricity to the land owners in that section, for pumping water and irrigating their farms. It is also stated that the company intends constructing a pumping plant for the purpose of pumping water from the Columbia River for irrigating the lands on the west side of the stream.

SPOKANE, WASH.—10,000 hp will be developed at the Inland Empire Railway Company's new power plant at Nine Mile Bridge, 12 miles north of Spokane, and it is announced by Jay P. Graves, president of the company, that there will be facilities for increasing the capacity to 20,000 hp. The plant will cost $50,000. Sanderson & Porter, of New York, N. Y., have been engaged as designing and constructing engineers, and William F. Zimmerman, mechanical and electrical engineer, has been engaged by the railway company to have direct supervision of the power development. Work has begun and it is expected to have the plant in operation in 12 months. Harnessing of the Chelan Falls, west of Spokane, for the purpose of generating electrical energy to operate a railway line between Spokane and Seattle, is also planned by Jay P. Graves and his associates. Options have been taken on lands and franchises have been secured in various towns in the Big Bend country. The project involves an expenditure of $10,000,000.

HONAKER, W. VA.—W. J. Weenman and others contemplate developing the Clinch River and building an electric plant for transmitting electricity to Honaker.

KENOSHA, WIS.—The Kenosha Gas & Electric Company is now installing a new engine and generator in its plant. R. N. Kimball is manager.

MEDFORD, WIS.—The Medford Light & Heat Company is contemplating installing a 100-hp boiler in its plant and the construction of a new smoke stack. F. S. James is manager.

LADYSMITH, WIS.—The Ladysmith Lighting Company is erecting a new power house and installing a new water wheel to operate its plant by water power. G. E. Newman is manager.

KILBOURN, WIS.—Bids will be received by Daniel W. Mead, Chief Engineer, at Madison, for excavating about 100,000 cu. yds. sandstone rock from the proposed raceway of the Southern Wisconsin Power Company.

IRON RIVER, WIS.—The Iron River Water, Light & Power Company is contemplating extending its lines to Nebagamon and Brule for lighting service; also developing water power on Brule River. I. M. Reeve is manager.

WEST MILWAUKEE, WIS.—The new electric lighting system installed by the Milwaukee Electric Railway & Light Company was put in operation Aug. 1 for the first time. There are 16 2,000-cp arc lamps in the street lighting system.

EAU CLAIRE, WIS.—The Chippewa Valley Electric Railway Company has been granted a 22-year lighting power franchise. The company is to put in a new power plant and also to transmit power from Cedar River to Eau Claire for manufacturing purposes.

PIEDMONT, W. VA.—The Piedmont Electric Light & Power Company has recently placed orders for machinery, which will greatly increase the capacity of its plant. The additional machinery to be installed consists of one 342-hp Russell engine, two boilers of 300 hp capacity and a 250-kw alternator made by the Warren Machine Company. H. B. Carroll is president and manager.

FREDERICTON, N. B.—The New Brunswick Telephone Company has decided to increase its capital from $650,000 to $1,000,000 for improvements. During the past few years this company has paid a dividend of 8 per cent.

PORT ARTHUR, ONT.—The council has decided to call for tenders for a 600-kw generator for the power plant. J. McTeigue is town clerk.

GRAVENHURST, ONT.—The citizens voted August 3 to spend $60,000 in constructing an electric plant and $48,000 to install a system of water works.

KINCARDINE, ONT.—The Board of Commissioners of water works and electric light plant is contemplating installing an additional engine in the municipal electric light plant. A. Ingram is manager.

SELKIRK, ONT.—The Selkirk Electric Light & Power Company has sold its plant to a syndicate headed by Flavelle Bros., Lindsay, Ont. Price, $40,000. The new company will make a number of improvements.

SOUTHAMPTON, ONT.—The Saugeen Electric Light & Power Company is preparing to install a 250-hp engine in its plant to use when water power is not sufficient. Norman Robertson is secretary and treasurer.

CHATHAM, ONT.—The Chatham Gas Company is contemplating adding a 275-kw alternator and changing the frequency to 60 cycles. The company will establish a twenty-four hour service. P. S. Coate is manager.

NIAGARA FALLS, ONT.—Orders have been placed by the Ontario Power Company with the Westinghouse Electric & Manufacturing Company for two 7,500-kw, alternating-current generators and for two 12,500-hp turbines. W. N. Ryerson is superintendent.

BOWMANVILLE, ONT.—The Bowmanville Electric Light Company, Ltd., is contemplating changing its system in the town to three-wire and to two-phase, 60-cycles, 6,600-volt alternating current for country service to furnish light and power. The company will also install an automatic telephone system. The plant has been recently purchased by the Stark Telephone, Light & Power Company, Ltd., of Toronto. W. K. Greenwood is superintendent.

LACHUTE, QUE.—Owing to trouble in securing water power the Lachute Electric Light Company will install in the near future a suction gas plant of sufficient capacity to operate its plant. Joseph Palliser is owner and manager.

MONTREAL, QUE.—The Montreal Light, Heat & Power Company is erecting a power house near lock four of the Soulanges Canal, about forty miles from Montreal. The Allis-Chalmers Company has the contract for putting in five turbines, the three largest of which will have a capacity of 5,350 hp each; the two smaller turbines will have a capacity of 300 hp each. Three generators of 3,750 kw each will also be installed.

VANCOUVER, B. C.—H. W. Kent, secretary of the British Columbia Telephone Company, Ltd., announces that the central offices at Greenwood and Grand Forks will be rebuilt at a cost of $25,000; also that the company will extend a line direct from the boundary to Rossland.

SAN ANGEL, MEX.—It is reported that the light and power system (with the exception of the Contreras power plant), owned by the firm of S. Robert y Cia., and which has been serving the people of San Angel, Coyoacan, Mixcoac, Tacubaya and other suburban places, has been purchased by the Mexican Light & Power Company, Ltd. Chas. H. Cahan, of Montreal, Que., is general attorney for the Mexican Light & Power Company, Ltd. It is stated that improvements are to be made in the plant.

New Incorporations.

ZANESVILLE, OHIO.—The Star Ice & Storage Company has been formed with a capital stock of $100,000 by John Hoge, S. A. Weller, C. T. Marshall and others. The company will erect a large ice producing and storage plant which will be equipped with its own electric lighting plant, elevators, etc.

CINCINNATI, OHIO.—The East Fork Heat, Light & Power Company, of Cincinnati, O., has been incorporated, with a capital of $10,000 by Walter C. Taylor, Eugene O. Doole and others for the purpose of developing the East Fork and Little Miami Rivers for transmitting electricity for heat and light.

CINCINNATI, OHIO.—The Little Miami Light, Heat & Power Company has been incorporated at Columbus by Walter C. Taylor, Harlow U. Farrell, C. W. Spicer, Edward Schlesinger and Henry S. Rockwell. The company proposes to build several dams in the Little Miami River between Plainville and Morrow. It is claimed that about 35,000 hp can be obtained the greater part of the year. Preliminary plans for the plant have been made by James A. Stewart, of Cincinnati. The company expects to furnish electricity in Morrow, Kings Mills, Lebanon, Middletown, Millford, Miamiville and several other towns in the vicinity of Cincinnati.

OKLAHOMA CITY, OKLA.—The East Side Telephone Company has been incorporated by F. L. Bath and others.

GUTHRIE, OKLA.—The Wellston-Luther Telephone Company has been incorporated with a capital stock of $10,000 by William S. Raupe and others.

KENDRICK, OKLA.—Articles of incorporation have been filed for the Kendrick & Avey Telephone Company, with a capital stock of $10,000, by Charles McClue and others.

HYDRO, OKLA.—Articles of incorporation have been filed by the Northwest Hydro Telephone Company, with a capital stock of $1,590. The incorporators are William Gist, W. M. Hafer and Frank Pitzer.

GUTHRIE, OKLA.—Articles of incorporation have been filed for the Goodnight Telephone Company, with a capital stock of $900. The directors are P. Morrison, R. B. Frame, J. F. Ralston, of Goodnight; E. Clark and J. C. McMillian, of Perkins.

CHEYENNE, OKLA.—The Clinton, Cheyenne & Canadian Interurban Railroad Company has been chartered with a capital of $1,000,000, to build an interurban line from Clinton, Okla., to Canadian, Tex. The incorporators are C. S. Gilkerson and others.

LONE STAR, OKLA.—The Barnmittz Farmers Mutual Telephone Company, of Dewey, has filed articles of incorporation with a capital stock of $15,000. The directors and officers are: P. D. Jones, president, of Elmo; W. D. Fine, secretary and treasurer; Elias Jones, of Burmah; E. Crowder, of Elm, and J. A. Addington, of Aledo, directors.

ST. HELEN, ORE.—The St. Helen Mill & Power Company has been incorporated to build a water power plant on Tontle River, near the outlet of Spirit Lake in St. Helen District. The plant will have a capacity of 35,000 hp. A. H. Trego is president.

PORTLAND, ORE.—Articles of incorporation have been filed for the Portland & Sandy River Electric Company, with a capital stock of $100,000, by M. F. Donohoe, Daniel J. Malarkey and Charlotte. The company will acquire and build electric railways, etc.

WHEATLAND, PA.—The Wheatland Street Railway Company has been chartered with a capital of $6,000, to build a line one mile long through the streets of Wheatland.

HALIFAX, PA.—Articles of incorporation have been filed by the Interline-Halifax Telephone & Telegraph Company, with a capital stock of $5,000, by W. H. Miller and others.

MILL HALL, PA.—The Long Electric Light, Heat & Power Company has been incorporated to furnish light, heat and power to the people of Mill Hall, Salona and adjacent territory.

KECKSBURG, PA.—Application will be made for a charter on August 23 for the Citizens' Telephone Company, of Kecksburg, with a capital stock of $2,000, by the farmers of Mt. Pleasant and Unity Townships.

DUNCANNON, PA.—The Eastern Perry Telephone & Telegraph Company has been organized with a capital stock of $5,000 for the purpose of building a new telephone system from Montgomery's Ferry to Enola.

MUNCY, PA.—The People's Electric Light, Heat & Power Company has been organized, with A. D. Foucart, president; Stephen Soars, vice-president, and Frank M. Opp, secretary. The company will apply to the City Council for a franchise to erect poles and wires throughout the town.

HARRISBURG, PA.—The Pennsylvania & Maryland Street Railway Company, with a capital stock of $200,000, was chartered at the State Department last week to build a 30-mile system radiating from Somerset, Pa., to Berlin, Brother's Valley, Garrett, Meyersdale and Salisbury. The officers are: C. H. Jennings, president; George W. Kipp, M. E. Lilly, D. H. Clark, H. H. Maust, John M. Wright, J. L. Barchus, directors.

WEKOTA, S. D.—The Freedom Rural Telephone Company has filed articles of incorporation with a capital stock of $5,000. The incorporators are John Stephenson, Charles Halsig, of Millard, and Charles Bates, of Faulkston.

New Industrial Companies.

THE STANDARD ELECTRICAL WORKS, of San Francisco, Cal., has been incorporated with a capital of $100,000 by R. J. Davis, H. Dibbler, A. M. Funke, A. S. Armstrong and H. C. Thaxter.

THE STANDARD ELECTRIC CONSTRUCTION COMPANY, of San Francisco, Cal., has been incorporated by Nathan Fallek, F. G. Shrewsburg, Andrew Smith, Anna Van Maren and E. W. Levy. The capital stock is $10,000.

THE LAKEDALE AUTOMOBILE COMPANY, of St. Louis, Mo., has been incorporated with a capital stock of $15,000. The object of the incorporation is to manufacture, buy and sell automobiles. The incorporators are W. J. Rea, J. A. Prescott and G. B. O'Reilly.

THE TECHNICAL PUBLISHING COMPANY, of San Francisco, Cal., has been incorporated with a capital stock of $100,000 by R. J. Davis, Albert J. Dibblee, E. B. Strong, C. L. Cory and A. M. Hunt. This company will publish the *Journal of Electricity, Power and Gas.*

Legal.

ASSESSING TELEPHONE FRANCHISES.—The Indiana State Board of Tax Commissioners has rendered an important decision in an appeal of the Kokomo Citizens' Telephone Company from the assessment of its property by the Howard County Board of Review. The latter assessed the company's franchise granted to it by the city of Kokomo. The company held that its franchise was not assessable, and that the County Board had no jurisdiction over it. The State Board held that county boards have nothing to do with the assessment of corporations that come within the scope of the State Board, and that the law gives the State Board sole authority in assessing the property of telephone companies. Whether or not franchises are assessable was not determined.

CHICAGO TELEPHONE INJUNCTIONS.—Five additional injunctions against the Chicago Telephone Company in the matter of the use of extension desk telephones by subscribers have been granted by Judge Gibbons in the circuit court. The injunctions were granted after an order had been entered before Judge Gibbons allowing the Chicago Flexible Shaft Company, the Independent Brewing Association, Peckham, Smith, Vincent J. Walsh and another firm to file intervening petitions to the petition for injunction filed by the Long-Critchfield Corporation. The injunctions restrain the Chicago Telephone Company from interfering with the service of the complaining concerns. To the firms it means a confirmation of their contention that they have a right to purchase extension telephone apparatus from other concerns than the Chicago Telephone Company. According to the complainants, the telephone company had refused either to sell them the extension telephone apparatus and private switch boards or to allow them to purchase elsewhere. They contended that the rental price charged by the telephone company was excessive.

Obituary.

MR. C. KING.—A special dispatch from Fort Collins, Col., of August 4, says: "Carleton King, president of the Northern Electric Company, died this morning after an illness of about two weeks. Mr. King was a native of New York State and was 35 years of age. He came to Fort Collins last spring and was chosen president and manager of the Northern Electric Company. Mr. King attended the Elks' reunion in Denver, where he caught cold, which resulted in pneumonia. He was a member of the local lodge of Elks and was highly respected by all who knew him."

MR. H. S. WOODMAN.—A special dispatch from Meredith, N. H., of August 7, says: "Harry S. Woodman, local manager Meredith Electric Light Company, was instantly killed by a live wire at 5.30 p. m. He was fixing an arc lamp near the railroad station, when he fell to the ground, a distance of 30 feet. Mr. Woodman was an expert electrician. He had remarked a few minutes before the accident that the power was on and he would have it shut off before proceding with the work. He was 32 years old, a son of Capt. O. R. Woodman of the steamer *Meteor.* He leaves a wife and a boy 7 years old."

Personal.

MR. BAXTER REYNOLDS, formerly of the Nernst Lamp Company, is now in charge of the electrical department of Fairbanks, Morse & Co., in the East, with headquarters at 12 Dey St., New York City.

MR. GEORGE BLAKELEY, local manager of the Northwestern Telephone Company, at Grand Forks, has been appointed district manager for the northern part of North Dakota, with headquarters at Grand Forks.

W. W. HANSCOM, formerly chief electrician with the Union Iron Works of San Francisco, has resigned to take the position of general superintendent of the Century Electric Construction Company of that city.

MR. D. A. HEGARTY has resigned as general superintendent and chief engineer of the Railways Company General and accepted a position as general manager and treasurer of the Little Rock Railway & Electric Company, of Little Rock, Ark. He entered upon his duties August 1.

MR. H. H. HERRICK has become local manager of the Owatonna, Minn., Gas Electric & Heating Co., in place of Mr. C. L. Powell, who has resigned, but will remain general manager. Mr. W. F. Wilford returns to his regular position as superintendent of the plant. Mr. Herrick filled some years ago the position he now takes, and has been connected with the company in various capacities.

MR. W. W. S. BUTLER.—Mr. W. W. S. Butler, of Grand Rapids, Mich, has been appointed general manager of the Newport News and Old Point Railway and Electric Company and its constituent companies, the Citizens' Railway Light and Power Company, Norfolk and Atlantic Terminal Company, Hampton Roads Traction Company, and Newport News Gas Company. Mr. Butler is a man of broad experience in street railway operation, having recently been general superintendent of the Grand Rapids street railways.

BRADY-GARVAN.—Mr. N. F. Brady, vice-president and treasurer of the New York Edison Company, was married on Aug. 11 at St. Joseph's Cathedral, Hartford, Conn., to Miss Genevieve Garvan, daughter of Mr. and Mrs. Petrick Garvan, and sister of Assistant District Attorney Garvan of New York City. The announcement of the marriage comes as an equal surprise and pleasure to the friends of Mr. Brady, who in his quiet way has won a host of admirers in electrical circles. It is understood that a wedding tour of three or four months will be made in Europe, and that Mr. and Mrs. Brady will be "at home" early in December.

MR. A. E. WINCHESTER, superintendent of the municipal electric light plant of South Norwalk, Conn., and fire commissioner of that city, has returned home from England, where he served as a member of the commission of inquiry of the National Civic Federation to investigate the working of municipal ownership. The fire brigade turned out to greet him with a fife and drum corps, and all the "red fire" in town was used up. He was presented with a handsome gold badge and was given a supper at one of the hose houses of the fire brigade. The big steam whistle of the municipal plant was also kept at full blast for five minutes to inform the countryside that Winchester had got back safe and sound. Mr. Winchester brought with him a lot of municipal data, some English up-to-date dialect, and an Irish shillelagh.

MR. T. A. EDISON has not only put a new cement on the market but takes a strong interest in cement construction. He says that new houses in the near future will largely be built of concrete. "The first step will be to employ an architect to design, say, a dozen dwelling houses of different patterns. I purpose to have metallic moulds made to correspond. The mould for each house will be made in detachable parts. There will be separate plates and small moulds that can be screwed together easily to form one mould for an entire house. That a fine finish may be obtained, the inside surface of the parts will be nickel plated. After the mould for the whole house is set up it will be a simple matter to pump the concrete into every nook and cranny. After four days the parts of the mould will be unscrewed and taken off and the solid concrete house will remain."

Trade Publications.

HEAVY-DUTY ENGINES.—Bulletin No. 1505 of the Allis-Chalmers Company, Milwaukee, Wis., describes the constructive details of heavy-duty engines of the belted type.

ELECTRIC LIGHTING SUPPLIES.—The 1906 catalogue of the W. S. Hill Electric Company, New Bedford, Mass., is a 78-page publication devoted to knife switches, switchboards, panel boards and cut-outs.

REVOLVING FIELD GENERATORS.—Bulletin No. 1080 of the Fort Wayne Electric Works, Fort Wayne, Ind., gives a well illustrated description of polyphase revolving-field generators of the engine-driven type.

ENGINE INDICATORS.—The Lippincott Steam Specialty & Supply Company, Newark, N. J., has issued a well illustrated bulletin devoted to indicators, reducing wheels and planimeters, which describes the construction of indicators and reducing wheels in great detail.

PENBERTHY PUBLICATIONS.—The Penberthy Injector Company, Detroit, Mich., announces that its monthly publication, entitled "Engineer and Fireman," will be increased in size from 32 to 62 pages. This publication contains many items of interest and value to the users of steam apparatus.

MECHANICAL FILTRATION.—Catalogue F of the United Water Improvement Company, Fifteenth and Chestnut Streets, Philadelphia, gives a well-prepared description of water purifying apparatus built according to the Hungerford system of mechanical filtration and the Nosmaer system of ozonization.

RECORDING INSTRUMENTS.—The Bristol Company, Waterbury, Conn., has issued as bulletin No. 41 a little general descriptive matter which simply touches upon the many different types and ranges of its recording instruments. This bulletin, which is arranged primarily for easy reference, is not intended to take the place of the large illustrated catalogue which is supplied by the company upon request.

INTER-POLE MOTORS.—Publication No. 521 of Veritys, Ltd., 31 King St., Covent Garden, W. C., London, England, gives a convincing argument as to the advantages incident to the use of interpoles on commutating motors, and describes motors of the interpole type built under the Verity-Hirsch patents. These motors are built for a speed range of from 1:4 to 1:5 by shunt regulation, the brushes being always in the neutral line.

FUSE BLOCKS AND SWITCHES.—Bulletin No. 18 of the H. Krantz Manufacturing Company, 160 Seventh St., Brooklyn, N. Y., in addition to an outline description of fuses and switches manufactured by this company, gives much interesting information concerning the design of high-grade knife switches. In all of the solid conduting parts the current density is on the basis of 750 amperes per square inch. The sliding contacts are based on 50 amperes per square inch, and bolted contacts 100 amperes per square inch for back connection and 150 amperes for front connection.

THE ELECTRIC STORAGE BATTERY COMPANY, of Philadelphia, has just issued the 6th edition of price list "A," which includes a description of all types of the "Chloride" accumulator applicable to central station lighting and power, electric railway power, isolated lighting and power stations, railway car lighting, etc., etc. In this edition is also catalogued auxiliary apparatus used in connection with "Chloride" accumulator installations. This price list will be forwarded upon application to the general offices at Philadelphia or to the sales offices throughout the United States.

SLOW-MOTION STARTING SWITCHES.—Publication No. 521 of Veritys, Ltd., 31 King St., Covent Garden, W. C., London, England, is devoted to slow-motion starting switches. The Cyclax gear, which can be applied to almost any radial-arm starter, prevents the starting of a motor too rapidly. The gear is so arranged that the handle must be turned around some eight times before the radial arm is brought over to the position of full spread. This type of starting switch is used on motors of capacities up to and including 30 hp. For larger motors up to 1,000 hp a screw-type of startng switches is employed.

MURGAS WIRELESS.—The Murgas Wireless Telegraph system of the Universal Aether Telegraph Company, 925 Chestnut Street, Philadelphia, invented by Father Murgas, of Wilkesbarre, Pa., is the subject of a handsome descriptive pamphlet, with numerous illustrations. The system was described in our pages some time ago by Mr. E. W. Stevenson and has many distinctive features, notable among which is the production and reception of a distinct musical tone, in the spark gap and at the telephone receiver; the number of sparks occurring in a time unit equalling the number of vibrations of a desired tone. Very full details are given as to the modus operandi.

THE AMERICAN INSTRUMENT COMPANY, with factory in Newark, N. J., and business headquarters in Philadelphia, has just issued a comprehensive catalogue of high-grade, direct-current switchboard and portable voltmeters and ammeters. In addition to general descriptive matter with illustrations, the catalogue contains data as to dimensions of switchboard instruments and shunts, together with necessary particulars for drilling switchboards. The catalogue is decidedly attractive in appearance and should be obtained by all who have occasion to buy or use electrical instruments. Inquiries for it should be addressed to James G. Biddle, general sales agent, 1114 Chestnut St., Philadelphia.

ASBESTOS PACKINGS.—The tendency of modern steam plants to use higher steam pressures than heretofore has called for a better class of steam packings than has hitherto been necessary. The use of packings made of rubber or organic materials is not advisable, as such packings will not satisfactorily withstand the high pressures and high temperatures to which they are subjected. Packings made of asbestos fibre, on the other hand, have been found to meet all requirements of this service. The well-known firm of H. W. Johns-Manville Co. has achieved great success with its line of "J-M" asbestos packings, as these are thoroughly reliable and are made in various forms to meet every requirement and condition. These packings possess the highest heat-resisting properties, are extremely durable and do not harden or blow out under the most severe conditions. No rubber or organic materials are used in their make-up and they will withstand any degree of temperature or pressure, are extremely pliable and will readily conform to irregular surfaces. The H. W. Johns-Manville Co., New York, will shortly issue an attractive catalogue showing its complete line of "J-M" asbestos packings, and copies of this will be mailed free upon request.

News of the Trade.

MESSRS. H. M. BYLLESBY & COMPANY, INC., engineers, Chicago, have been appointed engineers and managers of the Mobile Electric Company, of Mobile, Ala. A new modern power house will be erected immdiately and the lines of the company extended and rebuilt.

L. B. ALLEN CO., INC., Chicago, maker of the Allen fluxes, soldering sticks, salts, pastes, commutator lubricants, etc., received a letter recently from the manager of one of the largest electrical supply houses in the country, which said: "Allen goods sell themselves." This gentle encomium, quite unsolicited, rather pleases the firm.

GARRETT A. VALLEE & CO. is the name of a new electrical supply house opened at 38 North Sixth Street, Philadelphia, Pa. The president of the company, after whom it is named, was 25 years with the firm of Vallee Bros. Electrical Co., and he has therefore enjoyed an experience both large and long in this field. About August 15 he will open a store and warehouse at the above address with a full line of electrical supplies; and he invites orders, inquiries and correspondence as well as catalogues and price lists.

C. J. TOERRING COMPANIY, of Philadelphia, the manufacturer of arc lamps, has moved its office and factory this week to its new building in that city at 2121-2127 Toronto Street, south of Allegheny Avenue. This fine headquarters will give the company increased facilities for production. The new factory is built of reinforced concrete, with wire blass windows, and is thoroughly fireproof throughout. Mr. Toerring has secured a widespread reputation as an arc lamp manufacturer, and his product is in use all over the world.

HOLOPHANE GLASS COMPANY.—The central stations of this country are very rapidly awakening to the necessity of giving their customers not only the maximum amount of light but also the best illumination possible. An example of this awakening to the need of better illumination is that of the Portland General Electric Company, Portland, Ore., which has secured the services of Mr. H. M. Lauritzen of the engineering department of the Holphane Glass Company for a period of two months to assist it in the designing of lighting of numerous installations which are now under way, to assist the architect in the correct laying out of the lighting scheme before the buildings are wired; also to instruct its salesmen to lay out the lighting in order to get the best illumination possible. So great has been the demand for this class of work that the Holophane Glass Company announces for the present no more engagements can be made for members of its engineering staff for this class of work.

Weekly Record of Electrical Patents.

UNITED STATES PATENTS ISSUED AUG. 7, 1906.

[Conducted by Rosenbaum & Stockbridge, Pat. Attys., 140 Nassau St., N. Y.]

827,702. LEAD REFINING APPARATUS; Anson G. Betts, Troy, N. Y. App. filed Oct. 31, 1902.

827,719. EAR MUFFLE; Julius R. Engelman and Otto Partenheimer, Jersey City, N. J. App. filed Apr. 11, 1906. Device for use in connection with telephones for shutting out foreign and disturbing sounds from the ear which is not covered by the telephone receiver, consisting of a cup of yielding material having an exteriorly projecting throat, a handle passing through the throat from the outside to the inside of the cup, the said handle having a recess formed in it adapted to permit the escape of air from the interior of the cup.

827,721. PROCESS OF PRODUCING SALTS OF OXACIDS OF CHLORIN; Arthur E. Gibbs, Niagara Falls, N. Y. App. filed Mar. 25, 1904.

827,766. MOTOR VEHICLE; August Weiss, Cologne, Germany. App. filed Apr. 27, 1905.

827,781. INTERRUPTER FOR ELECTRICAL CIRCUITS; Herman Besser, New York, N. Y. App. filed Sept. 25, 1905.

827,782. ELECTRICAL INTERRUPTER; Herman Besser, New York, N. Y. App. filed Nov. 22, 1905.

827,787. TELEPHONE SYSTEM; Elmer R. Corwin, Chicago, Ill. App. filed Dec. 15, 1904.

827,802. PROCESS OF TREATING IRON OR STEEL; Henry L. Hollis, Chicago, Ill. App. filed July 7, 1905.

827,825. PARTY LINE SYSTEM OF TELEPHONES; Henry B. Stocks, Manchester, England. App. filed Sept. 5, 1905.

827,827. RAIL BOND; Charles R. Sturdevant, Mansfield, O. App. filed Dec. 2, 1904. The rail bond is provided with a terminal adapted to be applied to the surface of the rail to be bonded and in which provision is made of means for offsetting the surface of the bond terminal from the surface of the rail to which the terminal is to be applied sufficiently to form a space between such surfaces to receive solder by which the bond terminal is secured to the rail.

827,829. TROLLEY; George C. Thomas, New York, N. Y. App. filed Aug. 26, 1905. Details of a trolley adapted for use in connection with an elevated track of I-beam form.

827,836. SYSTEM FOR CHARGING STORAGE CELLS; Asbury G. Wilson, Wilkinsburg, Pa. App. filed Jan. 13, 1906. Means are provided for alternately charging and discharging the cells and of interchanging the functions thereof in such a manner that while one cell or set of cells is being charged, another cell may take its place in the discharging circuit to which the first mentioned set was previously assigned.

827,661. SECONDARY BATTERY; William Gardiner, Chicago, Ill. App. filed Sept. 23, 1904.

827,914. ELECTRIC BATTERY; Isidor Kitsee, Philadelphia, Pa. App. filed May 3, 1905.

827,915. ELECTRIC BATTERY; Isidor Kitsee, Philadelphia, Pa. App. filed May 3, 1905.

827,916. SUBMARINE TELEGRAPHY; Isidor Kitsee, Philadelphia, Pa. App. filed Feb. 12, 1904. The submarine cable is supplied with a device with the aid of which sounders or other electromagnetic devices may be actuated to increase the receiving capacity of the cable.

827,917. ELECTRIC CELL; Isidor Kitsee, Philadelphia, Pa. App. filed Feb. 20, 1904.

827,918. ELECTRIC CIRCUIT; Isidor Kitsee, Philadelphia, Pa. App. filed Apr. 1, 1904.

827,919. TELEGRAPHY; Isidor Kitsee, Philadelphia, Pa. App. filed Oct. 14, 1905. The invention consists of means for simultaneously transmitting two messages over a line comprising two transmitters, a key adapted to be manually operated, a source of current for one transmitter, a variable resistance, means for automatically varying the resistance, a manually operated key and source of current for the second transmitter, both transmitters being in operative relation to the line of transmission.

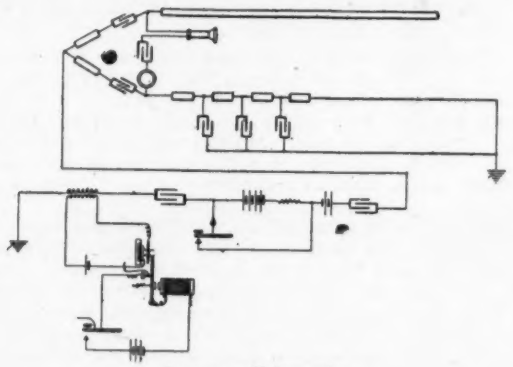
827,923. ELECTRICAL CONTROLLER; David Larson, Yonkers, N. Y. App. filed June 19, 1905. Details of an electric switch actuated by an electro magnet energized by alternating currents.

827,924. ELECTRIC ELEVATOR; David Larson, Yonkers, N. Y. App. filed July 24, 1905. The invention relates to a controlling system for electric elevators, such as are operated by alternating currents, and consists of a motor, a reversing switch therefor, electromagnets having cores free from the reversing switch, but arranged to control the same and independent means for actuating the reversing switch when one of the magnets is energized.

827,925. ELECTRICAL CONTROLLERS; David Larson, Yonkers, N. Y. App. filed Sept. 8, 1905. An electro-responsive device is employed comprising an electro magnet having a core and a winding, a second electro magnet having a core and an electro-magnetic holding device, and a winding for the holding device, the said winding being in circuit with the winding of the first magnet.

827,951. CABLE JOINT HOUSING; John Anderson, Portland, Conn. App. filed Sept. 11, 1905. Details of a housing for cable joints for excluding air and moisture from the joined wires of telephone, telegraph, electric light and other cables.

827,964. RELAY; William W. Dean, Chicago, Ill. App. filed Sept. 23, 1904.



827,919.—Telegraphy.

827,968. SECONDARY BATTERY; William Gardiner, Chicago, Ill. App. filed Aug. 31, 1904.

827,988. COUPLING APPARATUS FOR ELECTRIC CIRCUITS; Nicholas F. Niederlander, St. Louis, Mo. App. filed Sept. 2, 1902. Relates to coupling apparatus for connecting electrical circuits extending through a train of cars, and for making such couplings automatically and for permitting the breaking of the same automatically, in order to avoid danger to trainmen going between the cars and connecting or disconnecting such electric contact connections.

828,000. FIREALARM SYSTEM; Pearl E. Tarton, Ada, O. App. filed June 10, 1905. Consists of an indicator mechanism embodying means for indicating the numbers of various fire districts in a municipality or town and a magneto-electric generating mechanism operatively related to the indicator mechanism and comprising means for first selecting the number of the fire district for which the alarm is to be given and then controlling the indicator mechanism to be operated in such manner as to indicate that number. Also consists of an indicator mechanism wherein one indicator or plurality of indicator mechanisms may be operated separately or synchronously according to the number to be indicated.

828,014. ELECTROMAGNETIC RAILWAY SWITCH; Rollin A. Baldwin, South Norwalk, Conn. App. filed July 17, 1903. An electric railway switch point is moved first in one direction and then in the other with a single magnet, both movements being performed positively by the magnet, and not in one direction by the magnet and in the other by a spring. A movable bar is employed provided with a wedge-shaped projection, in connection with a thrust rod adapted to bear against the sides of the projection, to move the bar in the direction of its length, a V-shaped cam surface and a projection operating against the same, one of which is carried by the bar and the other by the rod, the projection being adapted to connect with one side or the other of the cam to shift the position of the rod, so that it will bear against any particular side of the wedge-shape projection.

828,033. PROCESS OF ELECTRIC WELDING; Laurence S. Lachman, New York, N. Y. App. filed July 28, 1905. The process described in this patent is intended especially for welding two sheets of metal together and consists in providing projecting portions upon one of the sheets and providing co-operating socket portions on the other sheet into which the projections may be thrust, passing a current of electricity through said sheets of metal and contact portions, thereby fusing the metal of the projections and sockets and simultaneously forcing the two sheets of metal together to securely weld one to the other.

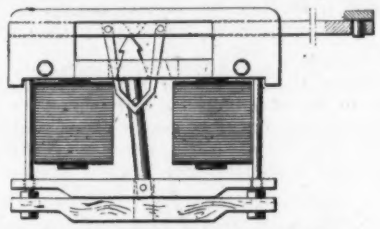
828,045. FIRE PROTECTION SYSTEM; James G. Nolen, Chicago, Ill. App. filed Sept. 17, 1904. For use in connection with a movable part of a fire protection system—such, for instance, as an automatic valve of an extinguisher system—an alarm system is employed which will indicate by a predetermined signal when the actuating part is so moved from its normal position that it is desirable to direct the attention of those having supervision of the protected area to the action of the movable part which has taken place.

828,046. FIRE PROTECTING SYSTEM; James G. Nolen, Chicago, Ill. App. filed Sept. 6, 1904. Means are provided, in conjunction with a fire extinguisher system, for indicating the commencement of the water flow through the piping of the system.

828,047. FIRE PROTECTION SIGNAL SYSTEM; John E. Shepherd, Chicago, Ill. App. filed Sept. 6, 1904. In connection with a valve of a fire extinguisher system, mechanism is employed for indicating the flow of water, said valve comprising a signalling device and a time switch for controlling the signalling device mounted within the valve casing and arranged to be actuated directly by the movable element of the valve.

828,061. TELEPHONE EXCHANGE SYSTEM; Charles E. Scribner, Jericho, Vt. App. filed Apr. 10, 1905.

828,077. METHOD OF COMMUTATING ALTERNATING CURRENT



828,014.—Electromagnetic Railway Switch.

ELECTRIC MOTORS; Hans Weichsel, Wilkinsburg, Pa. App. filed Apr. 10, 1905.

828,083. POWER TABLE AND POWER ATTACHMENT FOR TABLES; John T. Beswick & David Beswick, New York, N. Y. App. filed Jan. 24, 1906. Details of construction.

828,089. SWITCH KEY; Edward B. Craft, Chicago, Ill. App. filed July 5, 1904.

828,090. ELECTROMAGNETIC LOCKING SWITCH; Henry M. Crane, New York, N. Y. App. filed May 9, 1904. Consists of an electromagnet, a return pole-piece therefor, a lever pivoted upon the pole-piece, a push button for moving the lever, switch contacts closed by the lever when moved by the push button, and an armature for the magnet pivoted to the pole-piece and adapted when attracted to abut against the lever to hold the same in its actuated position.

828,092. ELECTRIC MOTOR SUPPORT; John G. Crawford, La Grange, Ill. Filed Jan. 2, 1904. Means are provided by which an electric motor may be adjusted in operative relation to the wheel of a sewing machine in such manner as to permit the motor to be tilted back out of the way when it is desired to get at the mechanism of the sewing machine, or where the machine is arranged to be let down below the table.

828,101. AUTOMATIC TELEPHONE EXCHANGE; Claude D. Enochs, La Crosse, Wis. App. filed Oct. 16, 1905.

828,137. SAFETY STOP VALVE; Charles W. Nicholson, Roslyn, Wash. App. filed Nov. 16, 1905. In connection with a valve casing having a valve seat, a reciprocable valve, a shaft journalled in the casing, means whereby the rotation of the shaft will reciprocate the valve and means for automatically rotating the shaft, are employed, together with means for restraining the rotation of the shaft and electro-magnetic means for releasing the restraining means.

828,210. MEANS FOR CONTROLLING ELECTRIC LIFTS, ELEVATORS, CONVEYORS, Etc.; Henry C. E. Jacoby, Harrow, England. App. filed Dec. 15, 1905. Details of construction whereby an elevator cage or car is caused to travel to any desired floor by pressing one of a row of push buttons in the car

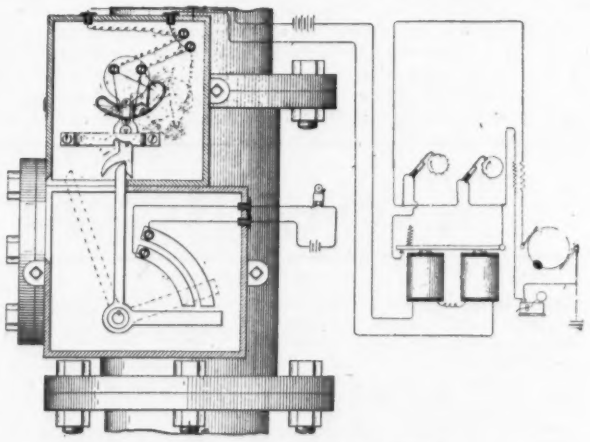
828,217. ELECTRIC TRANSMISSION OF INTELLIGENCE; Isidor Kitsee, Philadelphia, Pa. App. filed June 29, 1906.

828,218. TELEPHONE APPARATUS; Koby Kohn, New York, N. Y. App. filed Feb. 24, 1904.

828,235. CALL SYSTEM; William J. McCollom, Paterson, N. J. App. filed Feb. 24, 1904.

828,247. VENTILATING PLATE; John D. Riggs, Pittsburg, Pa. App. filed Jan. 6, 1905. The invention of this patent consists of a pressed end-supporting ventilating plate for dynamo electric machines, a flat or plane body portion containing one or more radial cuts and U-shaped ribs.

828,270. APPARATUS FOR MAINTAINING AIR PRESSURE IN ALE AND BEER CASKS; Edward R. Brown, Boston, Mass. App. filed



828,045.—Fire Protection System.

June 4, 1901. An electric motor and a pump actuated thereby are employed, in connection with an air storing tank connected with the pump, an electric switch, an operating lever therefor, means for automatically controlling the lever, a post serving to guide both the lever and the switch and connections between said switch and said lever including means for imparting an accelerated movement of the switch as the latter shifts its position.

828,271. TELEPHONE APPARATUS; Charles A. Bucklin, New York, N. Y. App. filed July 3, 1903.

828,292. POCKET AUDIPHONE; Eugene W. Schneider, New York, N. Y. App. filed Dec. 8, 1905.

12,519. MANUFACTURE OF CARBID; Herman L. Hartenstein, Constantine, Mich. App. filed May 1, 1906.